CENTRIFUGE

C3*i* / CR3*i*

SERVICE MANUAL

Jouan

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C3*i* / CR3*i*

SERVICE MANUAL

89000832-a

CAREFULLY READ THIS MANUAL BEFORE OPERATING YOUR INSTRUMENT.

REVISION STATUS

INDEX	DATE	AMENDED PAGES	NOTES
a	03/98		Initial release

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CONTENTS

1 INTRODUCTION

1.1. PURPOSE

This manual contains maintenance instructions intended for use by a qualified maintenance or service technician. It is organized to provide maintenance personnel with basic data on the theory of operation to assist in troubleshooting. Moreover, it outlines parts replacement and calibration procedures for putting the centrifuges back into service.

Should a specific maintenance problem arise which is not covered in this manual, please ask the authorized service organization in your area for assistance, or contact our after sales department :

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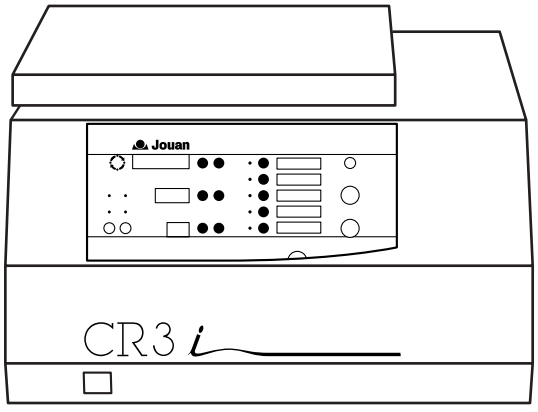
1.2. PRESENTATION

The C3*i* and CR3*i* (refrigerated) centrifuges are instruments designed for laboratory use. Using relative centrifuge force (RCF) allows elements of different density to be separated.

The rotor is the main load; a swing-out design allows a higher load than does an angle design. The larger the rotor diameter is, the higher the load can be and thus the slower the speed will be.

The RCF is directly proportional to the radius of sedimentation and to the square of the speed.

The gas used in the refrigeration system (CR3*i*) is R134a, without CFC, recommended by the directive for protection of the ozone layer.



1.3. SPECIFICATIONS

1.3.1. DIMENSIONS AND WEIGHT

Dimensions (H x W x D)	C3*i* : 372 x 400 x 495 mm	CR3*i* : 375 x 575 x 605 mm
Packed (H x W x D)	C3*i* : 600 x 610 x 540 mm	CR3*i* : 590 x 720 x 710 mm
Weight - uncrated / crated	C3*i* : 40 kg / 52 kg	CR3*i* : 72 kg / 85 kg

1.3.2. ELECTRICAL SPECIFICATIONS

Mains supply 220/240 VAC 50 Hz	C3*i* : 11175700	CR3*i* : 11175703
Mains supply 120 VAC 60 Hz	C3*i* : 11175701	CR3*i* : 11175704
Max power	C3*i* : 500 W	CR3*i* : 800 W
Average power	C3*i* : 350 W	CR3*i* : 550 W
Refrigeration		CR3*i* : 235 W

1.3.3. PERFORMANCE

Max speed	Swing-out : 4 000 rpm (C3*i*) Swing-out : 4 100 rpm (CR3*i*)	Angle : 14 000 rpm
Max RCF	Swing-out : 3 934 x g (C3*i*) Swing-out : 3 082 rpm (CR3*i*)	Angle : 18 407 x g
Max capacity	Swing-out : 4 x 280 ml	Angle : 6 x 100 ml
Microprocessor controlled		
Display	High visibility digital display	
Memory size	5 programs, direct access	
Program protection	Recall key lock	
Speed	Range 500 to 14 000 rpm Step 10 -100 rpm Accuracy ± 20 rpm	
Timer	Range 30 sec to 99 min + hold position Step 30 sec to 1 min	
Acceleration rates	5	
Braking rates	5	
Temperature (CR3*i*)	Range -9°C to +40°C Step 1°C Accuracy ± 1.5°C	
Typical performance	4°C at 4 000 rpm, (4 x 280 ml swing-out) 1°C at 14 000 rpm, (20 x 1.5 ml angle)	
Maximum density	1.2 g/cm^3	
Maximum energy	14 400 J	

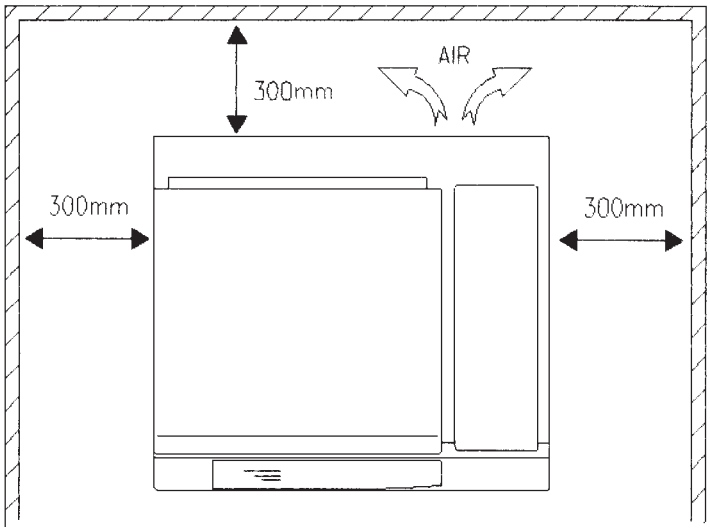
1.4. INSTALLATION PROCEDURE

The environment must not be in a dusty room or corrosive environment.

The bench top must be of a rigid construction capable of supporting the weight of the centrifuge.

IMPORTANT : at least two people are required to lift the centrifuge from the palette and place it on the bench.

WARNING : The rear panel of the instrument must be at least 30 cm from the walls to allows hot air coming from the condenser to escape.



2 THEORY OF OPERATION

2.1. DESCRIPTION

The microprocessor system which controls the C3*i* or CR3*i* centrifuges ensures the operation of the following major elements :

- Management of the operating modes
- Generation of alternating current amplitude and frequency
- Adjustable components for the motor speed servo
- Management of the acceleration and braking profile/rates
- Management of the temperature regulation (CR3*i*)
- Management of the safety devices :
  · Lid lock
  · Zero speed detection
  · Imbalance detection
  · Motor overtemperature detection.
- Management of fault diagnosis.

2.2. COMPONENT LAY-OUT

The inpout and control devices are located on the front panel and comprise a membrane keyboard and three digital displays.

Everything is controlled by a 16 bit microprocessor. The control program of the centrifuge is stored in an EPROM.

Data are conveyed into a dynamic RAM and are kept even when the power is down, thanks to an internal battery, which supplies power.

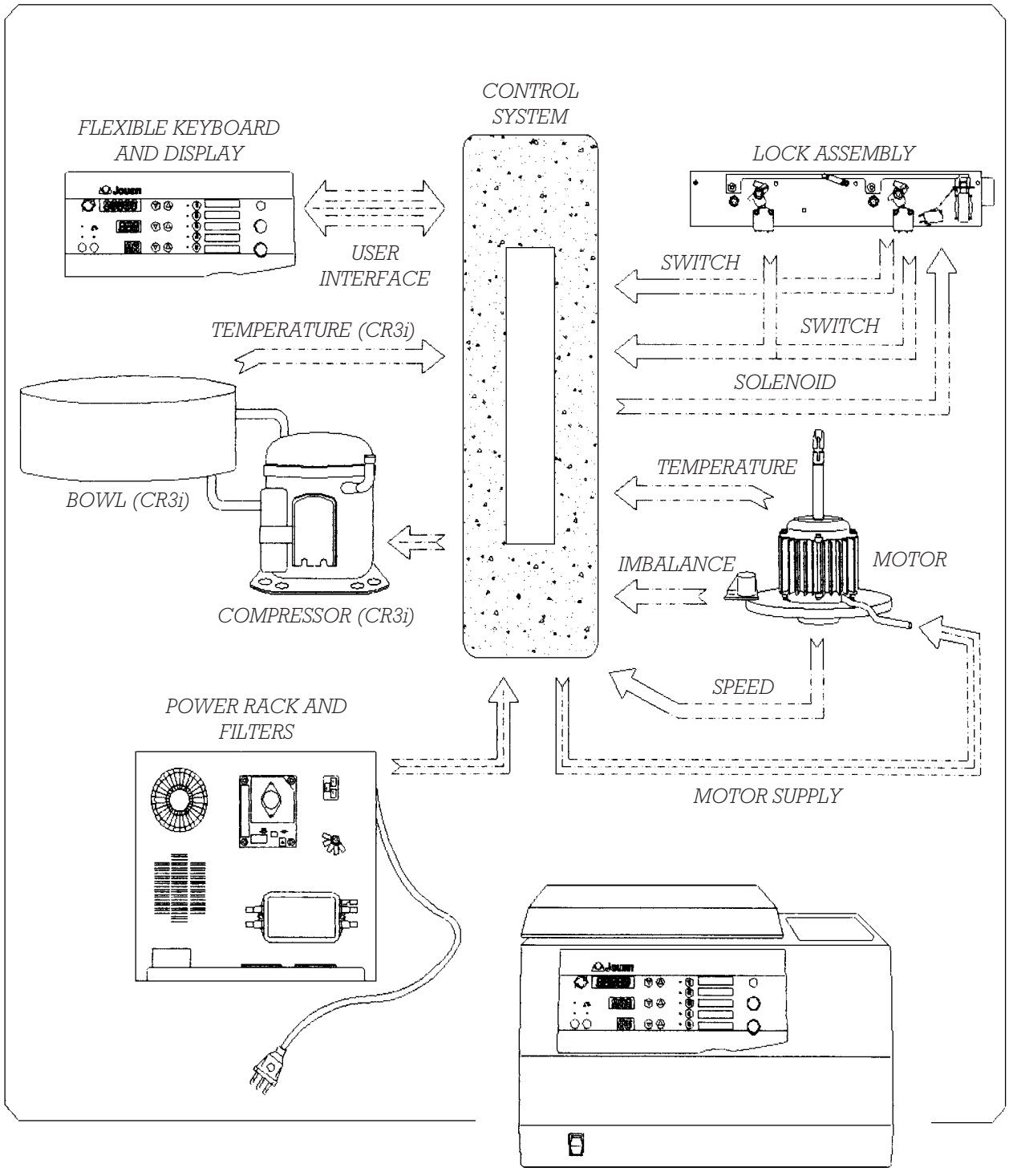


FIG. 2.1 - CR3i FUNCTIONAL PRESENTATION

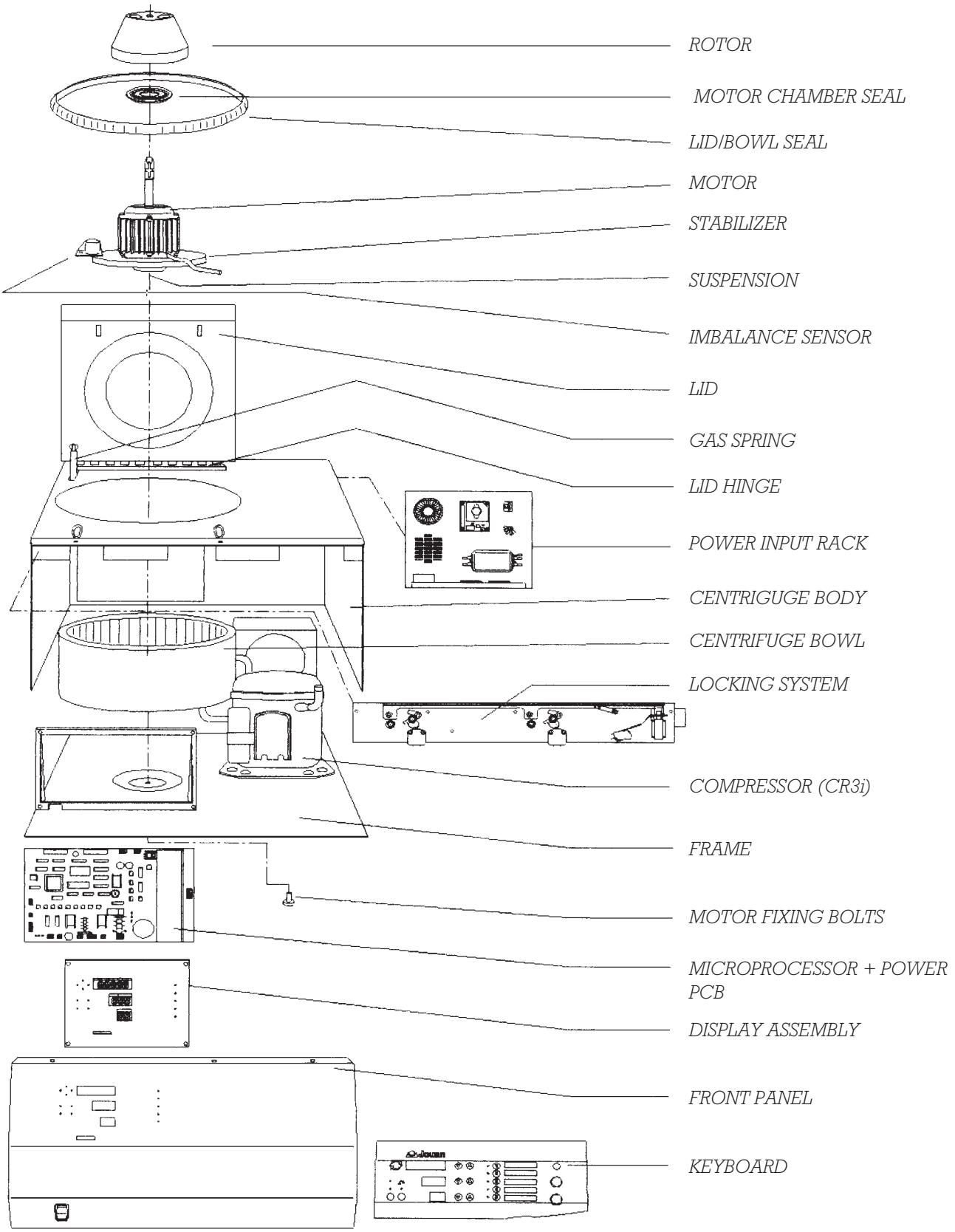


FIG. 2.2 - CR3i EXPLODED VIEW

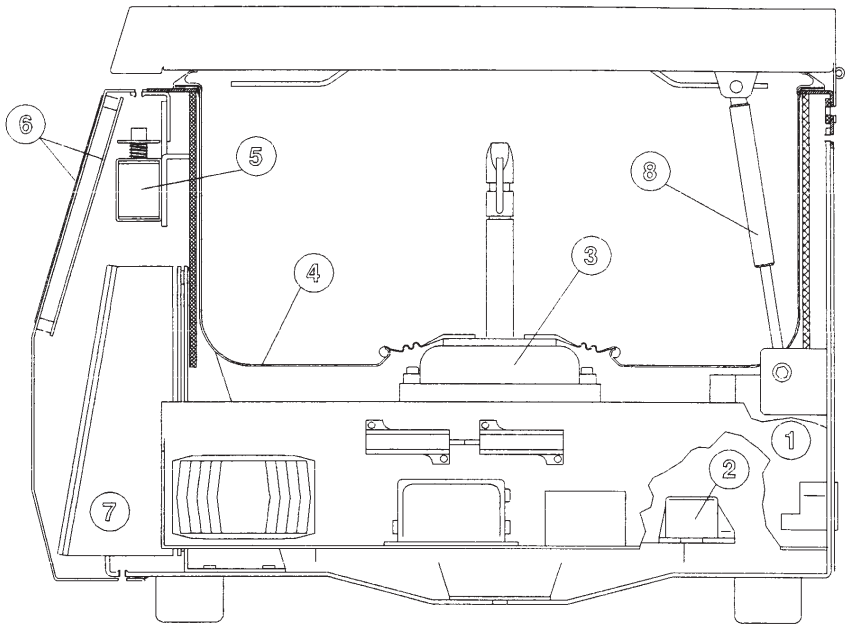


FIG. 2.3 - COMPONENTS OF THE C3i

1. Power supply rack
2. Imbalance sensor
3. Induction motor
4. Centrifugation chamber bowl
5. Lid lock solenoid
6. Display assembly and keyboard
7. Microprocessor/power pcb
8. Gas spring

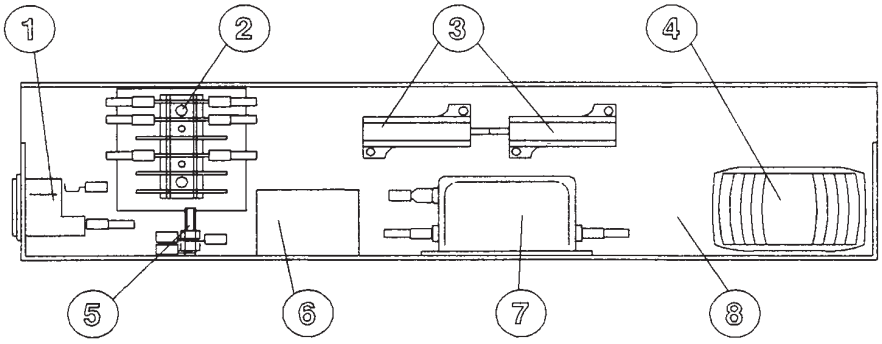


FIG. 2.4 - POWER SUPPLY RACK C3i

1. Main socket and fuse carrier
2. Fast-on connection strip
3. Braking resistance
4. DC tranformer
5. Ground/Earth
6. Motor earthing reactor
7. Mains filter
8. Rack

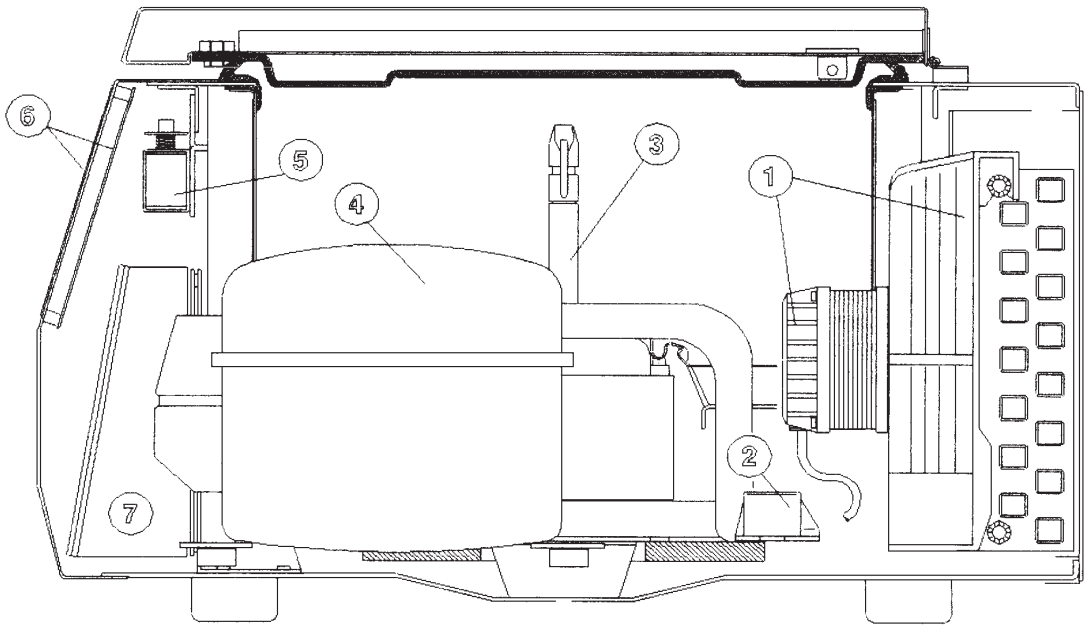
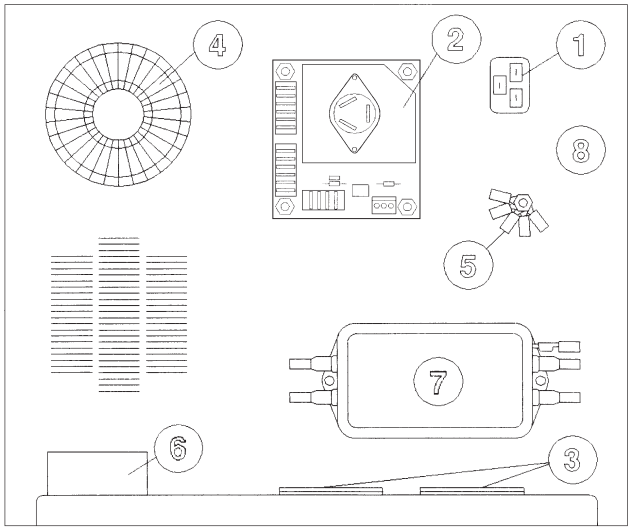


FIG. 2.5 - COMPONENTS OF THE CR3i

1. Cooling fan /condenser
2. Imbalance sensor
3. Induction motor
4. Compressor
5. Lid lock solenoid
6. Display assembly keyboard
7. Microprocessor/power pcb



1. Mains socket
2. Compressor pcb
3. Braking resistances
4. Transformer
5. Ground/ earth
6. Motor earthing reactor
7. Mains filter
8. Rack

FIG. 2.6 - POWER SUPPLY RACK CR3i

2.3. MOTOR CONTROL PRINCIPLE

2.3.1. INTRODUCTION

The C3*i*/CR3*i* family of centrifuges is fitted with an asynchronous 3 phase motor. During the centrifugation, the microprocessor generates a system of sinusoidal 3 phase voltages, variable in amplitude and frequencies. During the braking phase the energy from the rotating parts is commuted across a resistance.

2.3.2. THE MOTOR

The motor comprises a 3 phase stator and a short-circuited rotor.

When correctly powered, the stator creates a magnetic field rotating at the synchronised speed Ns :

$Ns = F/p$

F : supply frequency
P : number of pairs of poles of the motor

The rotating field generated in the motor induces e.m.f.'s. These e.m.f.'s produce currents in the short circuited rotor.

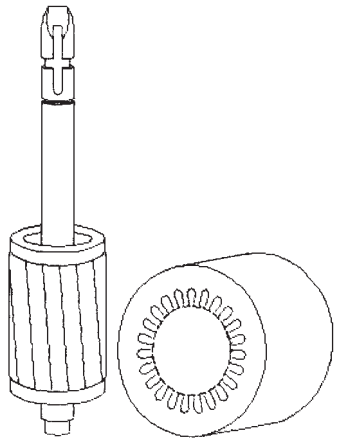
These induced currents found in the magnetic field create forces opposed to those which induced them.

It is the relative speed between the rotor and stator which is the cause of these induced currents, thus the forces will reduce this relative speed by driving the rotor at a speed close to that of the field created at the stator.

The difference (s) between the synchronised speed Ns and the actual speed N of the rotor is called the slippage.

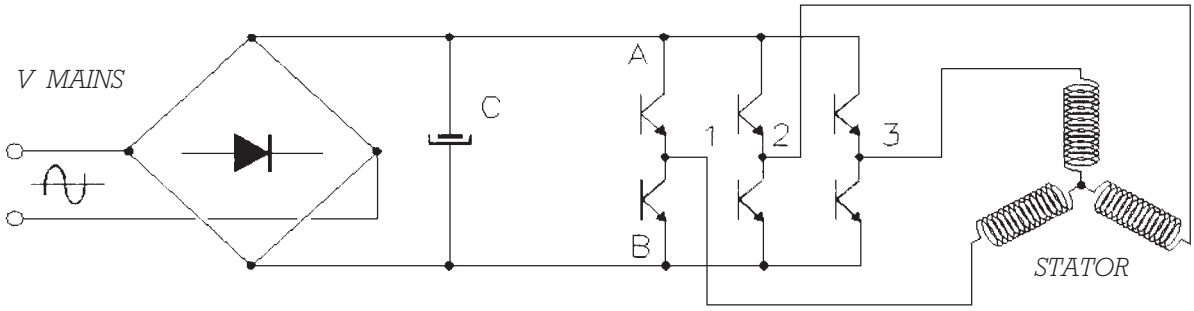
$$s = \frac{Ns - N}{Ns}$$

At a given frequency, the slippage value depends on the resisting torque (i.e. that of the rotor).



2.3.3. POWER CONTROL

Three voltages, variable in amplitude and frequency, dephased by 2π/3, must be supplied from a 50 or 60 Hz single phase mains supply.



The voltage is rectified then filtered by C to supply the constant voltage +E. The value of the capacitor C is high.

The 6 transistors act as switches (open or closed).

These transistors commute at a fixed frequency (8 kHz).

To affect the voltage at R we act upon the commands of the transistors a and b, b always being the opposite to a (a = closed, b = open). By changing the cyclic ratio (closed/open) we obtain a mean sinusoidal value so we are able to vary the amplitude and frequency.

It is necessary that the pilot frequency must be elevated compared to the frequency of the generated sinusoidal voltage. The latter is around 400 Hz at 24000 r.p.m. (f pilot / f sin = 10 at N max. speed).

In the same way, the voltages at points S and T will be sinusoidal between OV and +E and dephased by 2π/3 between them.

These 3 voltages are simple voltages varying between OV and +E. They are partly sinusoidal and partly on a baseline situated at +E/2. Thus the O of the sinusoidal voltage corresponds to 50 % of the cyclic ratio.

The voltages applied to the motor phases are the compound voltages VR-VS, VS-VT,VT-VR and will vary between + E and - E ([O-(+E) = -E]

Thus at the motor terminals are recreated the voltages whose amplitude is close to that of the mains.

Speed synchronisation is directly proportional to the frequency of the voltage supplied to the motor. Ns = f x 60 (for a 2 pole motor).

The motor rotates at a speed N below the speed Ns.

$\frac{Ns - N}{Ns}$ = SLIPPAGE (the slippage varies between 1 and 3%).

To vary the speed, it is necessary to vary Ns and thus the frequency of the voltage supplied to the motor.

The torque characteristics will be translated on the speed axis. The supply voltage will vary within 0 to 12000 r.p.m. in order to keep the U/f ratio constant and not saturate the magnetic circuit.

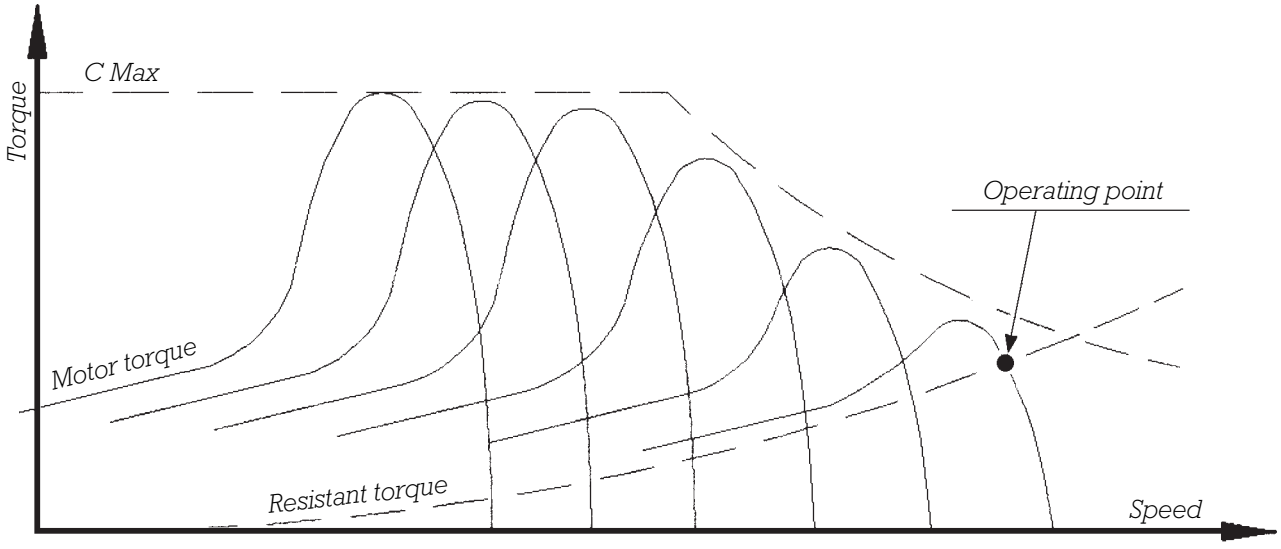


FIG. 2.7 - VARIATION OF THE CURVE OF THE MOTOR TORQUE AS A FUNCTION OF THE SPEED

2.4. ELECTRONICS - STRUCTURE

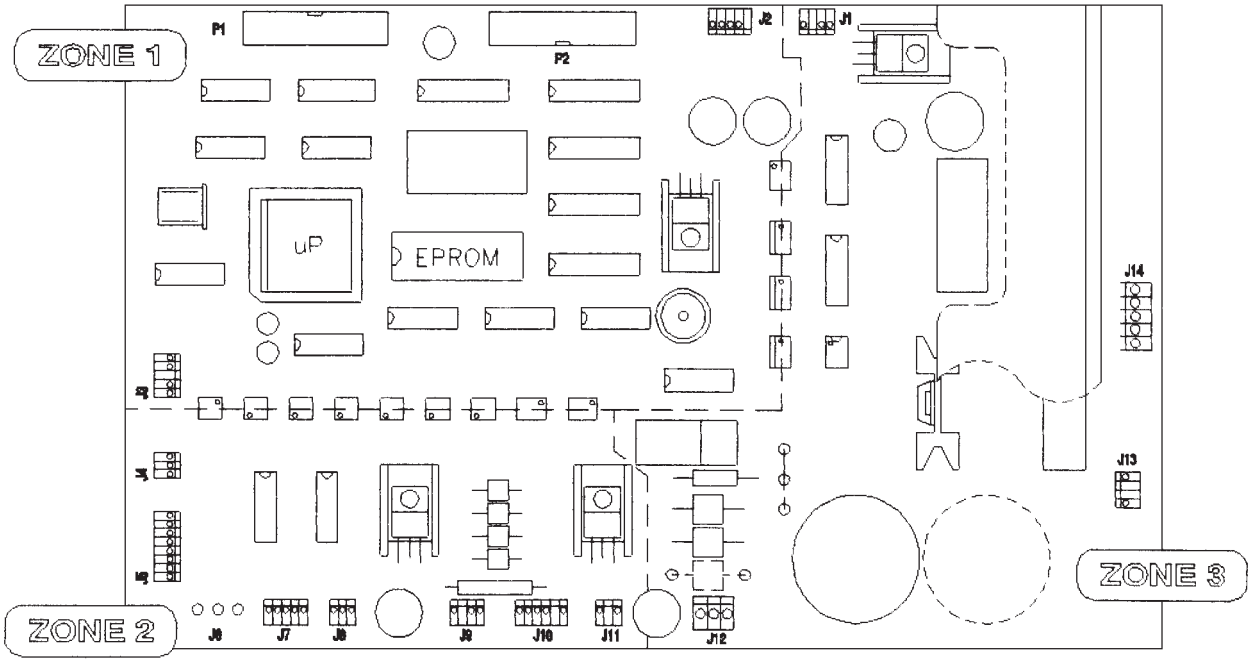
2.4.1. INTRODUCTION

The electronic part of the apparatus is formed of two boards : the microprocessor + power pcb, where every function is located and the user interface pcb with display and LEDs. The former is located inside the body of the machine (fig. 2.3 or 2.5, item 7), whereas the second one is in the back of the front panel (fig. 2.3 or 2.5, item 6).

The electronic imbalance sensor is located on the motor stabilizer (fig. 2.3 or 2.5, item 2) and allows the detection of and excessive imbalance due to the rotor loading.

2.4.2. MICROPROCESSOR + POWER PCB

On the microprocessor + power pcb, 3 distinct zones can be identified, whose functions are described below. Each zone has its own independent power supply.



ZONE 1 :

This zone includes the microprocessor, the EPROM containing the software and the non-volatile RAM containing the program parameters. The set of components in this zone is at the potential of the microprocessor : 5 VDC.

ZONE 2 :

This zone ensures the conformity of the signal type coming from the different detectors before their arrival at the microcontroller via opto couplers.

It also monitors the lid lock control and refrigeration group commands.

The power supply for this zone is 12 VDC.

The different signals coming to this zone are :

- Bowl temperature.
- Signal coming from the imbalance sensor
- Tacho signal
- Lid position signal
- The motor overtemperature and the lid lock solenoid control.

ZONE 3

WARNING ! THIS ZONE IS AT MAINS VOLTAGE

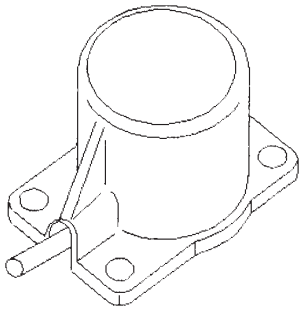
This zone isolated from the microprocessor part by opto-couplers, is the electronic part related to the power in the system. This zone includes :

- The 15 VDC power supply for the control electronics for this zone.
- The control circuit of the 6 basic signals of the IGBT module.
- The 3 PWR commands coming from the microcontroller
- The brake GBT with the command which permits flow through the braking resistor.-
- The diode bridge which, from the mains, charge the capacitor of the continous bus
- The relay which, controlled by the supply of power, then short circuits the resistance of the charge of the capacitors of the continuous bus a few moments after switch-on.
- The module of 6 IGBTs and its heat sink which power the motor.

2.4.3. IMBALANCE SENSOR

As described in the introduction, this sensor allows the detection of an excessive imbalance in the rotor loading.

A piezzo ceramic converts the energy created by the vibration into an electrical signal. After shaping, this signal is sent to the microprocessor for the safety devices.



2.4.4. TACHO SENSOR

The tacho sensor is comprised of an optical sensor, which, generates two pulses per revolution.

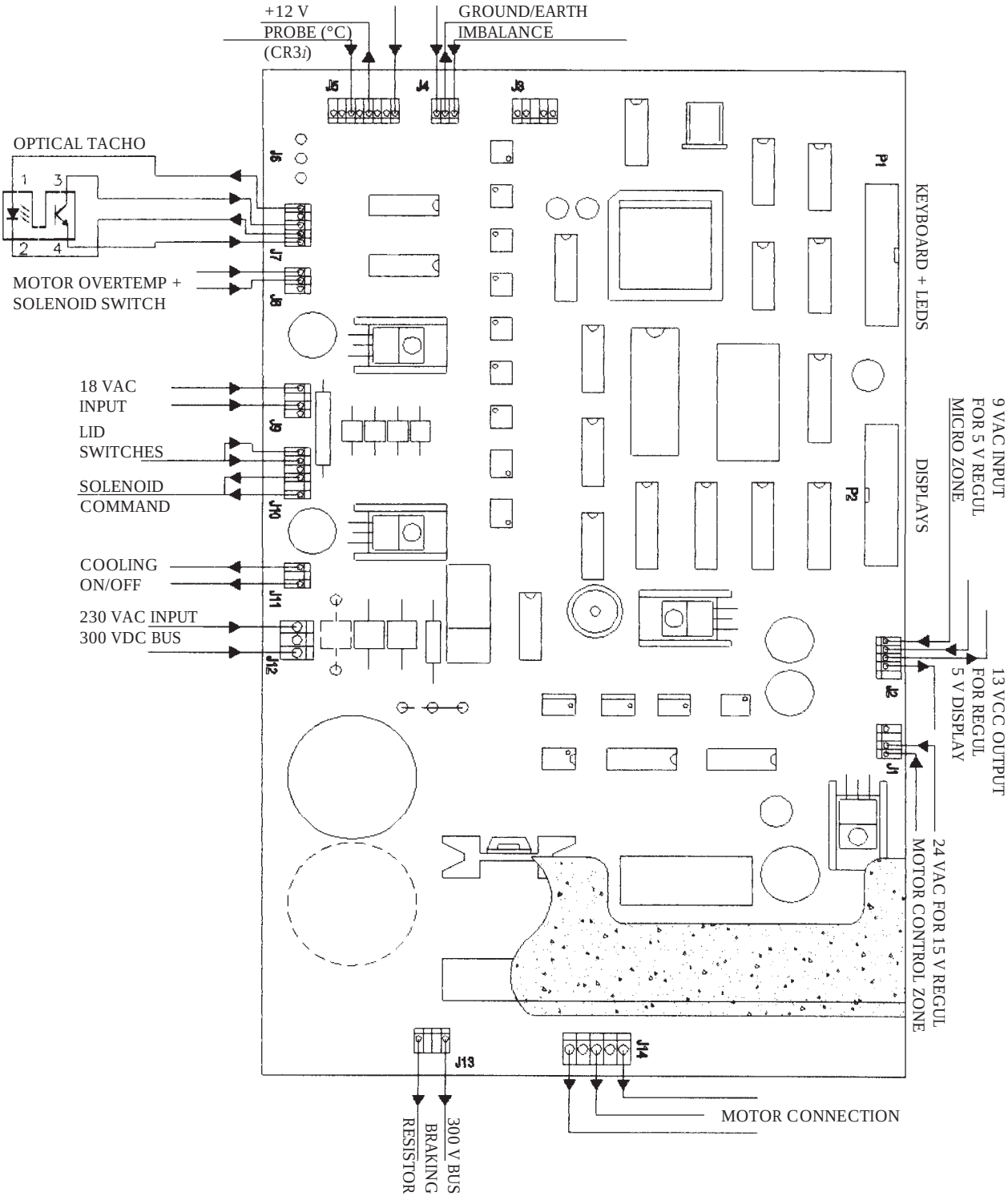
2.4.5. TEMPERATURE SENSOR (CR3*i*)

After the shaping circuit , the signal is 1.23 Vcc (0°C) ±80 mV/°C

2.4.6. REFRIGERATION CONTROL BOARD (CR3*i*)

The board controls the power signal to the refrigeration group.

2.4.7. INPUT - OUTPUT



3 DIAGNOSTICS AND REPAIRS

3.1. INTRODUCTION

The C3*i* and CR3*i* are equipped with a diagnostic menu in order to help locate possible breakdowns. The possible conditions of incorrect functioning are communicated to the user by means of error codes on the display and buzzer alarms.

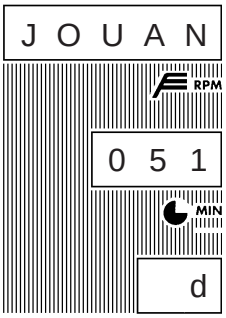
3.2. FUNCTIONAL TEST

Certain functional tests can be done directly using the keyboard and display.

These tests must only be undertaken by someone qualified to do so. They are protected by an access code.

3.2.1. EPROM VERSION

The first message that appears when the machine is switched on remains active for a few seconds (machine set up).



The word JOUAN appears, underneath which is a two figure number (in the timer display) indicating the type of EPROM fitted to the centrifuge.

Example : 51 = C3*i*, 52 = CR3*i*

The EPROM index letter is identified on the temperature display.

3.2.2. TEST MODE

This mode is accessible by using a combination of keys while the machine is setting up.

Press on the following two keys at the same time:

acceleration programming key

braking programming key

Test 1 : Temperature probe calibration and other tests

0 0 0 0 0	5 digit display :	Actual speed
T - 1	3 digit display :	T-1 for test 1
2 0	2 digit display :	actual temperature

Temperature calibration(CR3*i*) :

It is possible to calibrate the temperature measuring line by connecting pins 2 and 3 of the J5 connector on the microprocessor/power pcb. To do this it is sufficient to displace J5 one pin higher.

In this case the temperature reading must be 37°C (to ±5°C before calibration).

Pressing simultaneously on the ▽△ temperature programming keys calibrates the measuring line. Display then shows 37°C.

It is then possible to "manually" adjust the temperature calibration coefficients by pressing on the key corresponding to program 3. The following messages are displayed :

3 8 8	5 digit display :	Temperature value read by the microprocessor
1 0 0	3 digit display	Calibration coefficient value**
3 7	2 digit display	Calculated temperature value**

** Flashing display of these parameters.

Using the ▽△ time programming keys allows manual adjustment of the calibration coefficient.

Tachometer test

Turn the rotor by hand: the speed should appear on the 5 digit display.

Lid solenoid test

Press on the key corresponding to program 2 to power and/or release the solenoid.

Resetting of the 5 programs

Keep pressing on the key corresponding to program 4.

Complete program resetting on RAM

Press simultaneously on the △ speed programming key and the PULSE key to allow complete resetting of the machine when it is next switched on.

- Press START to pass to the next test
- Press STOP to leave the test mode

Test 2 : Calibration of imbalance detection threshold

Standby and/or end of cycle :

I M B A L	
3 5 0	Imbalance threshold
- -	

Pressing on PULSE begins a preprogrammed cycle at 2500 rpm during which the maximum imbalance is recorded.

The set value is 350.

Using the ▽△ time programming keys allows manual adjustment of the imbalance threshold.

During the cycle :

0 0 0 0 0	Actual rotating speed
0 0 0	Maximum imbalance reading
- -	

- Press START to pass to the next test
- Press STOP to leave the test mode

Test 3 : Run linking

This test safely used in the factory, starts a series of preset runs after having pressed the pulse key :

C Y C L E	Run cycles of the selected program can be run with a one minute pause between each.
- - -	
6	Press ▽ and △ to change the number of runs from 1 to 99.

During a run, when rotating, displays are the same as they would be outside the test mode.

Between two runs (1 minute pause) displays are :

C Y C L E	
0 5 9	Counting down before the next run (seconds)
2	Next run number

- Press START key to go to the following test
- Press STOP key to exit from the test mode.

Test 4 : Statistical analysis

S T A T S	Press ▽ and △ to scroll on the 5 digit display
- - -	
0	1 : running hours total (x 100) 2 : total number of runs 3 : number of hours above 5000 rpm 4 : number of runs above 5000 rpm

- Press START key to go back to test 1
- Press STOP key to exit from the test mode

3.3. FAULT CODES

When certain faults are detected an audible alarm is switched on in addition to a code and a message.

According to the fault, the machine stops automatically under the conditions indicated in the following table.

Code	Reason	Comments/exit
ERR 1	During rotation measured speed suddenly = zero.	Tacho info considered unreliable. Cycle stops without braking. Lid opening impossible for 10 minutes.
ERR 2	Values of successive speed measurements too different.	Idem code 1
ERR 3	Run does not function normally.	Idem code 1
ERR 4	Non zero speed when machine is switched on.	Machine expects to see zero spin. Exit = press a key or open the lid.
CLOSE LID ERR 5	Lid unlocked when START selected.	Start impossible Exit : press ENTER.
ERR 6	Lid unlocked during rotation	Run stopped using brake. Exit : press ENTER.
ERR 7	Imbalance detected	Idem code 6
ERR 8	Motor overtemperature (above 120°C)	Idem code 6
ERR 9	Chamber overtemperature (above 50°C).	Idem code 6
ERR 10	Operating anomaly	The machine is blocked and the keyboard is dead. Exit = Switch off the machine.

3.4. TROUBLESHOOTING CHART

Preliminary remark : when a fault is reported, first carry out the appropriate functional test, then refer to the troubleshooting chart below.

Problem	Possible cause	Remedy
1) No control active and no indicator lights ON.	No voltage being applied to the centrifuge.	Check mains outlet and power cable.
	Fuses blown (C3*i*).	Check for short circuits. Check the absence of short circuits with an ohm-meter (mains cable disconnected). Reset the circuit breaker (replace as required).
	Switching of the line differential (CR3*i*).	Check the insulation between the mains and the earth of the centrifuge.
	Short circuit at the power level.	Disconnect the mains wires arriving at the µP p.c.b. If there is still a short circuit at this level change the µP board or the capacitor. Check the connections.
	Short circuit on the +5V.	Check the presence of +5 V on the mother board with the board disconnected from the display board. If +5 V is present change the display board. If +5 V is absent check the resistance between the µP board earth and +5 V with the ohm-meter. If the resistance is zero, change the µP board. If not zero, carry out the following test.
	Absence of low voltage on the µP board.	Check the presence of alternating voltages on the transformer output.
	Faulty display.	Check the cables/connectors linking the µP board to the display card.
2) All controls inoperative. The display is lit up without information.	Faulty microprocessor board.	Check the cables/connectors to the display. Check the correct positioning: - of the EPROM on the µP board - of the microprocessor on the µP board.
3) Compressor test incorrect (CR3*i*).	Control fault.	Check the voltage applied to the compressor terminals. If not apparent or if incorrect, change the control board. If no effect, change the mother board. If correct (230 or 120 V according to the version) change the condenser and/or the compressor start-up relay. If no effect the compressor coils.
	Faulty compressor or its accessories.	
4) Lid lock solenoid test incorrect.	Control fault.	Check the voltage applied to the solenoid terminals. If not apparent or incorrect (far from 24 VDC) change the mother board or the transformer.
	Faulty solenoid.	If the voltage is correct, change the solenoid.

Problem	Possible cause	Remedy
5) Tacho test incorrect.	Faulty tacho.	Check the presence of a signal at the input to the mother board (with an oscilloscope or DC voltmeter). Pulses should appear every 12 sec. If absent or incorrect, change the tacho.
	Faulty µP board.	If the pulses are correct, change the µP board.
	Failure of the motor bearings.	Check by hand that the motor turns freely.
6) Vibrations.	Imbalanced load not detected.	Check and adjust, if necessary, the sensitivity of the imbalance detector (see ch. 5.1). If necessary, change the imbalance board.
	Incorrectly fitted rotor.	Check the condition of the drive shaft collet (plastic piece at base of shaft) and the spring washers placed below the collet. Change these pieces if necessary. Grease the washers. N.B. The shaft collet must slide freely on the drive shaft.
	Defective shock absorbers on motor.	Change shock absorbers.
	Defective or poorly fitted motor “nose” seal.	Change or refit the seal. Pay careful attention to positioning and gluing it.
	Failure of the motor bearings.	Check by hand that the motor turns freely and without noise or abnormal friction. If necessary change the motor.
7) Starting impossible. All controls and display are operational.	µP board power bridge broken down.	Change the µP board.
	Defective start switch.	Change the keyboard.

4 REPLACEMENT PROCEDURES

> **CAUTION : DISCONNECT THE MAINS POWER LEAD TO THE CENTRIFUGE BEFORE ALL REPLACEMENT PROCEDURES !**

Replacement of spare parts and adjustment are done using standard tools of a maintenance engineer specialised in laboratory equipment.

As a guide, a list is given in the appendix. If, for a particular reason, any other tools are required, these are clearly specified in the relevant chapter.

4.1. MOTOR REPLACEMENT

4.1.1. UNREFRIGERATED MODEL (C3*i*)

Dismounting

- Remove the pin (1) which joins the gas spring and the lid.
- Remove the front panel (2) by unscrewing the five screws and disconnect the power switch, the flat cable, the display supply and the front panel ground cable. Lift the bowl seal and unscrew the three press screws (3) of the chamber.
- Remove the bowl seal (4).
- Lift and remove the bowl (5).
- Disconnect the connectors (6) from the motor (J14), the tacho sensor (J4), the imbalance sensor (J7), the microprocessor + power pcb, the motor earthing faston and the thermoswitch connection.
- Unscrew the motor press screw (7) located at the base of the motor.
- Lift and remove the motor (8).
- To separate the stabilizer from the motor, insert Allen key n°4 between the cooling ribs of the motor perpendicularly to the screws. Repeat it for the 4 screws.

Refitting

- Carry out the above operations in the reverse order.

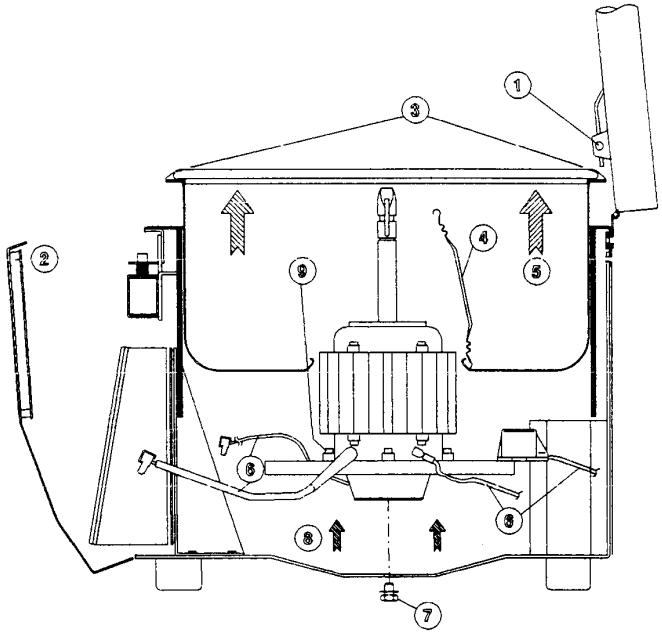


FIG. 4.1 - DISMOUNTING THE MOTOR OF THE C3i

4.1.2. REFRIGERATED MODEL (CR3*i*)

Dismounting

- Remove the front panel (1) by unscrewing the five screws and disconnect the power switch, the flat cable, the display supply and the front panel ground cable.
- Remove the Panduit connector from the motor (J14) and from the tacho sensor (J4) of the motor board (see connectors), then remove the motor earthing fastons and the thermoswitch connection.
- Remove the seal in the base of the bowl
- To separate the stabilizer from the motor, insert Allen key n°4 between the cooling ribs of the motor, perpendicularly to the screws. Repeat it for the 4 screws.
- Unscrew the motor screw located at the base of the rotor
- Lift the motor and withdraw it through the opening in the middle of the bowl

Remounting

- Carry out the above operations in the reverse order. It is easier to insert stabilizer screws before inserting the motor into the centrifuge.
- To remount the stabilizer lying on the bottom of the machine, present the motor and turn it until the bolts located in the lower part of the armature engage the holes in the stabilizer. Screw in the bolts which will lift the stabilizer until it is rigidly mounted against the motor.

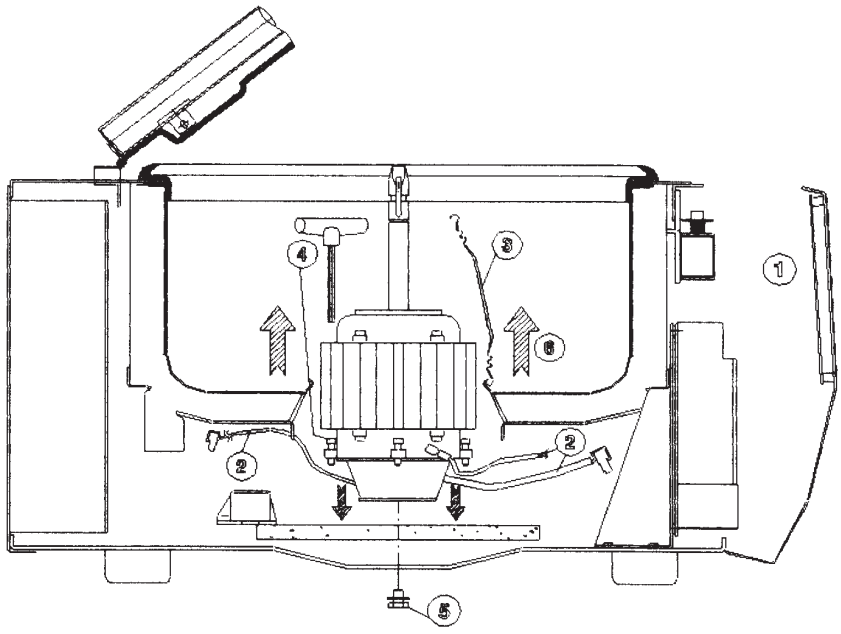
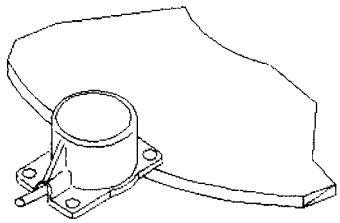


FIG. 4.2 - DISMOUNTING THE MOTOR OF THE CR3i

4.2. IMBALANCE DETECTOR REPLACEMENT

Dismounting

- On the C3*i*, lift the bowl seal and remove the 3 press screws to remove the bowl. On the CR3*i*, remove the front panel by unscrewing the 5 screws and disconnecting the power switch, the flat cable, the display supply and the front panel ground cable.
- Remove the microprocessor + power pcb, disconnecting all the electrical connections.
- The sensor is located on the motor stabilizer.
- Unscrew the 2 screws and remove the sensor from the stabilizer.



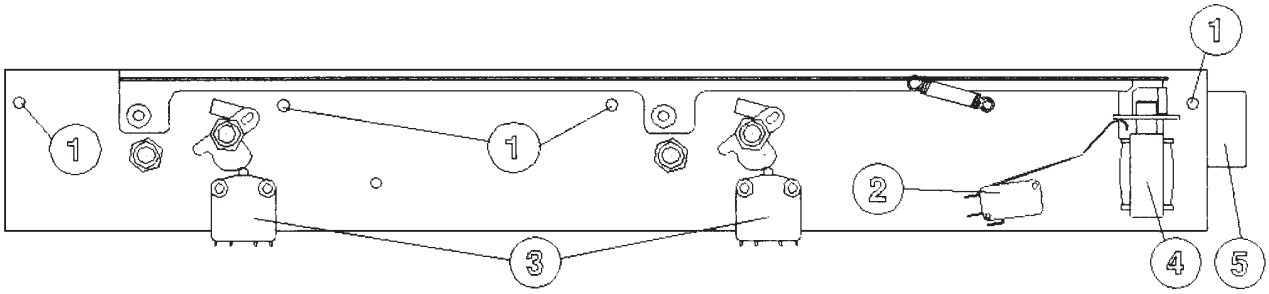
Refitting

- Carry out the above operations in the reverse order.

4.3. REPLACEMENT OF THE LID LOCK ASSEMBLY

Dismounting

- Open the lid
- Remove the front panel by unscrewing the 5 screws and disconnecting the power switch, the flat cable, the display supply and the front panel ground cable.
- Disconnect the lid lock assembly of the microprocessor + power pcb by disconnecting the J8 and J10 connectors.
- Unscrew the 4 nuts on the body of the instrument.
- Remove the lid lock assembly.

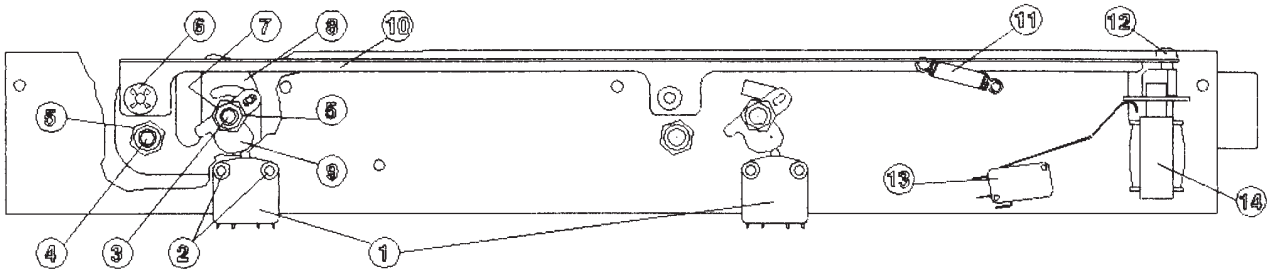


1. Nuts
2. Solenoid microswitch
3. Lid microswitch
4. Solenoid
5. Lid handle

Refitting

- Remount the lid lock assembly on the body, in alignment with the fixing points and keeping it in position thanks to the nuts (1).
- Check the correct position of the lock to have a convenient lid closing.
- Screw down the nuts to the body of the instrument.
- Reconnect the electrical connectors.
- Remount the front panel.

4.4. LID LOCK ASSEMBLY ELEMENT REPLACEMENT



4.4.1. LID LOCK MICROSWITCH REPLACEMENT

Dismounting

- Disconnect the microswitch.
- Unscrew the mounting bolts (2), dismount the microswitch.

Refitting

- Carry out the above operations in the reverse order. Check the microswitch rod does not hit the cam when the lid is open to avoid false alarm.

4.4.2. LID LOCK REPLACEMENT

Dismounting

- Unscrew the self locking nuts (5).
- Extract the screw (4) and the cam (9).
- Extract the serrated lock washer (6).
- Unscrew the bolt (7) located behind the cam (9).
- Maintaining the lock (8), unscrew and extract the screw (3).

4.4.3. LOCK SOLENOID MICROSWITCH REPLACEMENT

Dismounting

- Disconnect the microswitch (13).
- Maintaining it, unscrew the screw located on the diagonal

Refitting

- Carry out the above operations in the reverse order.

> ⚠ WARNING : THE MICROSWITCH ROD HAS TO BE SHAPED TO WORK PROPERLY AND TO GIVE A GOOD STROKE TO THE SOLENOID MOBILE CORE.

4.4.4. SOLENOID REPLACEMENT

Dismounting

- Disconnect the solenoid by cutting the 2 wires at the level of the sleeves.
- Supporting the solenoid, unscrew the screws on the back of the lid lock assembly panel.

Refitting

- Carry out the above operations in the reverse order.
- Check the stroke of the solenoid mobile core is unimpeded.
- Resolder the 2 wires to the solenoid, not forgetting to fit the insulating sleeves.

NB : Solenoid microswitch and lid lock microswitch replacement can be performed without having to remove the whole lid lock assembly.

4.5. POWER SUPPLY RACK REPLACEMENT

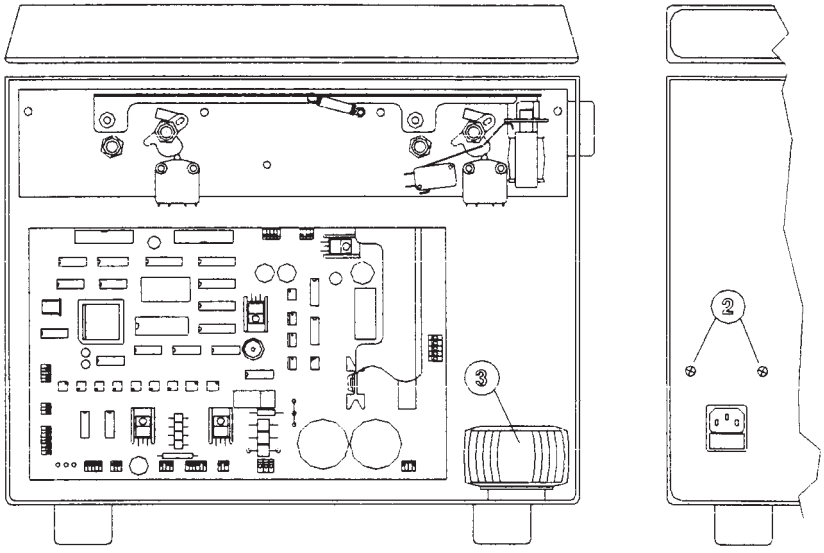
4.5.1. RACK REPLACEMENT FOR THE C3*i*

Dismounting

- Remove the front panel.
- Unscrew the 2 screws at the back of the machine.
- Unscrew the screw situated in front of the transformer.
- Remove all electrical connections : J1, J2, J9, J12, J13, supply and earth cables.
- Remove the rack.

Refitting

- Carry out the above operation in the reverse order.



4.5.2. RACK REPLACEMENT FOR THE CR3*i*

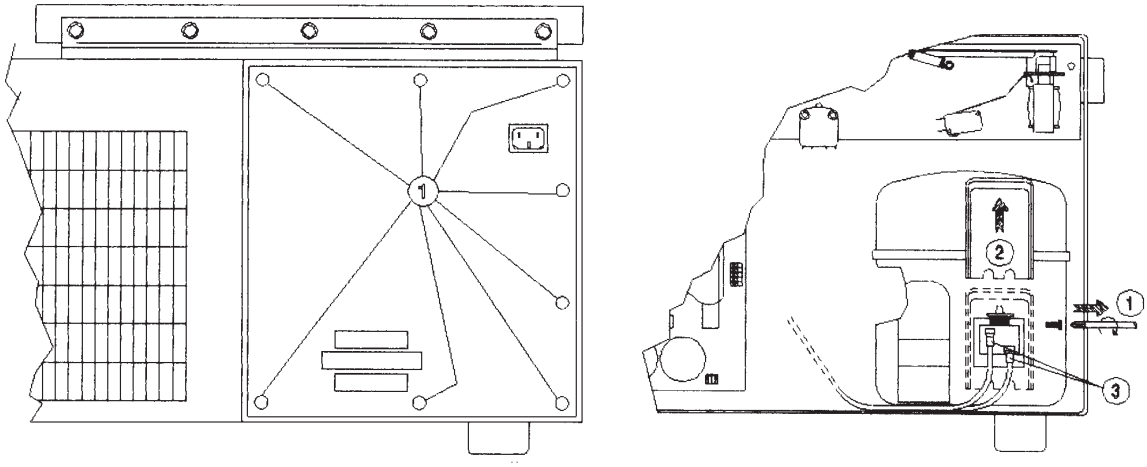
Dismounting

- Remove the front panel.
- Disconnect all wirings : J1, J2, J9, J11, J12, J13, supply and earthing cables.
- To disconnect compressor command cables, follow the diagram below methodically.
- Remove the back panel by unscrewing the 8 protection screws.
- Free the cables from their loom.
- Extract the rack.

Refitting

- Carry out the above operations in the reverse order.

WARNING : Carefully replace the cables in their original position.



4.5.3. REFRIGERATION BOARD REPLACEMENT (CR3*i*)

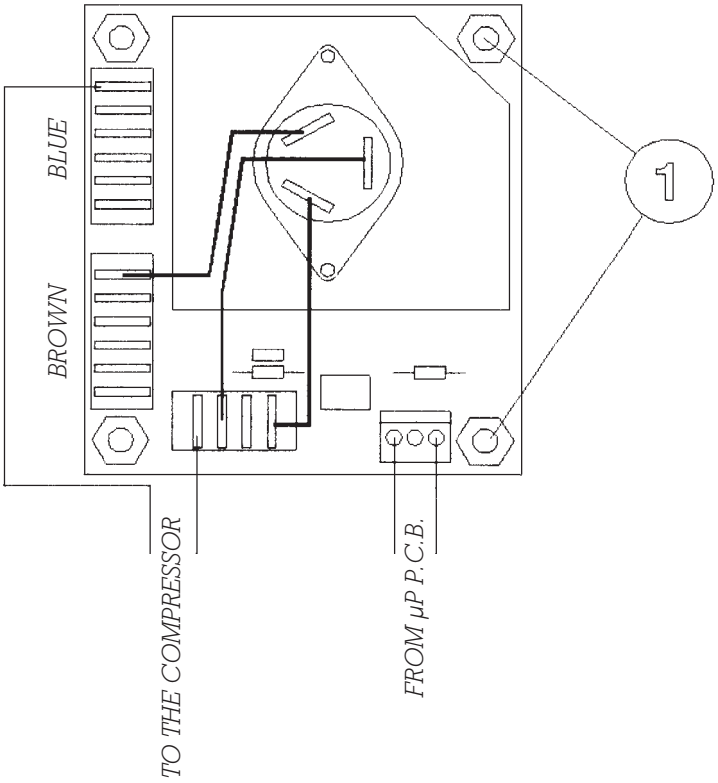
This board is bound to the supply rack (figure 2.6, item 2). It will be necessary to remove the rack, as described below, to have access to the board.

Dismounting

- Disconnect the board.
- Remove the board from the rack unscrewing the 4 screws (1).

Refitting

- Carry out the above operations in the reverse order.



4.6. ELECTRONIC BOARD REPLACEMENT

4.6.1. MICROPROCESSOR + POWER PCB

Dismounting

- Remove the front panel.
- Disconnect all cables from the board : J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11, J12, J13, J14, P1, P2.
- Unscrew the 5 screws holding the board; one in each corner and one in the middle of the board. Remove the board.

Refitting

Carry out the above operations in the reverse order, and do not forget to place the insulation sheet between the board and its support.

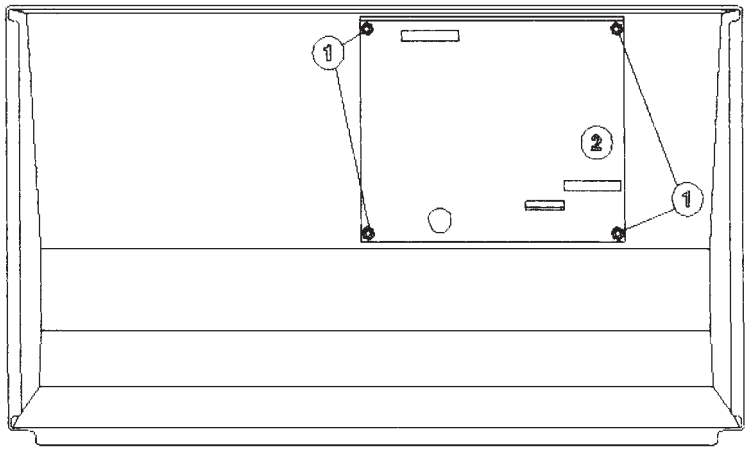
4.6.2. DISPLAY BOARD

Dismounting

- The board is located behind the front panel; the latter has to be removed by unscrewing the five press screws and by disconnecting the power switch, the flat cable, the display supply and the front panel ground cable.
- Unscrew the four holding nuts (1) and remove the board (2).

Refitting

- Carry out the above operations in the reverse order.



4.7. KEYBOARD REPLACEMENT

- Open the front panel and disconnect the keyboard.
- Unstick and remove the keyboard.
- Clean the plastic mounting
- Fit a new keyboard. Press firmly across the whole surface to ensure adhesion.

4.8. GAS SPRING REPLACEMENT

4.8.1. GAS SPRING REPLACEMENT ON THE C3*i*

The gas spring appears on the figure 2.3, item 8 (chapter 2). For its replacement follow the C3*i* motor replacement procedure (4.1.1).

- Follow motor replacement procedure from step 1 to 4 (included).
- Remove the 4 screws that fix the rack to the machine, then disconnect and remove the rack.
- Now only the foot of the gas spring remains screwed.
- Remove the screw and then remove the gas spring.

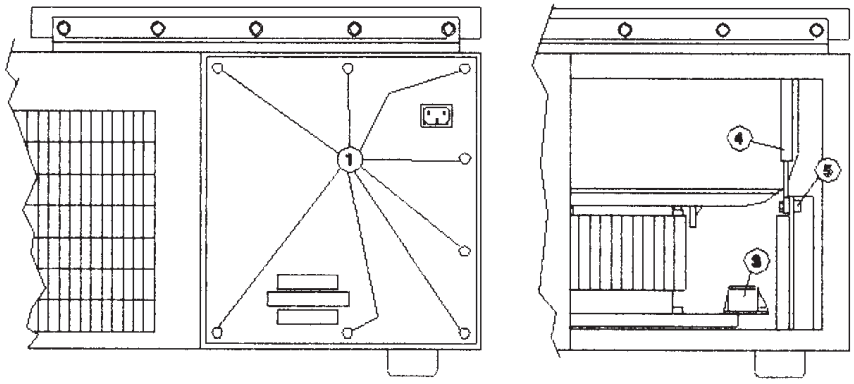
4.8.2. GAS SPRING REPLACEMENT ON THE CR3*i*

Dismounting

- Open the lid.
- Open the supply rack panel (1).
- Looking inside the machine from behind, the gas spring (4) can be easily seen on the right side.
- Remove the pin which joins the gas spring to the lid.
- Now only the foot of the gas spring remains connected.
- Remove the screw (5).
- Remove the gas spring.

Refitting

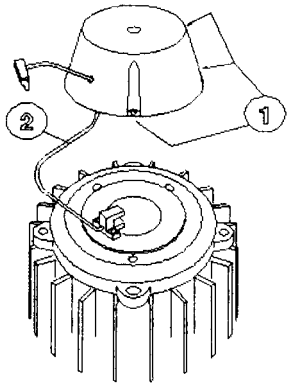
- Carry out the above operations in the reverse order.



4.9. TACHO REPLACEMENT

Dismounting

- Remove the shock absorber by unscrewing the 3 fastening screws.
- Unscrew the two locking screws of the optical sensor. Remove it while being careful of the cable.



Refitting

- Carry out the above operations in the reverse order.

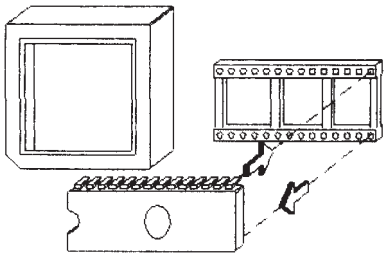
4.10. EPROM REPLACEMENT

> ⚠ WARNING : TO EXTRACT THE EPROM USE A PROPER EXTRACTOR AND NOT ANY TOOL THAT COULD DAMAGE THE EPROM AND ITS SOCKET.

> ⚠ WARNING : DURING THE REPLACEMENT, MAINTAIN THE EPROM PARALLEL TO ITS SOCKET.

Extraction

- Remove the front panel.
- To replace the EPROM, it is not necessary to remove the microprocessor + power pcb from its support.
- Extract the EPROM



Insertion

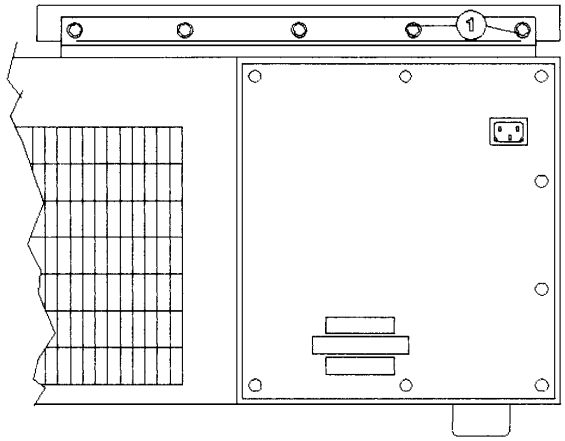
- See the adjacent figure.

> ⚠ WARNING : INSERT THE NEW EPROM WITH THE NOTCH TOWARDS THE MICROPROCESSOR.

- Execute the necessary calibration as explained in chapter 5.

4.11. LID REPLACEMENT

- Open the lid.
- As explained in the motor replacement procedure (4.1), extract the pin which binds the gas spring and the lid.
- Unscrew the 5 screws which bind the lid to the hinge (1).
- Remove the lid.



4.12. REFRIGERATION GROUP REPAIRS (CR3*i*)

4.12.1. REFRIGERATION GROUP REPLACEMENT

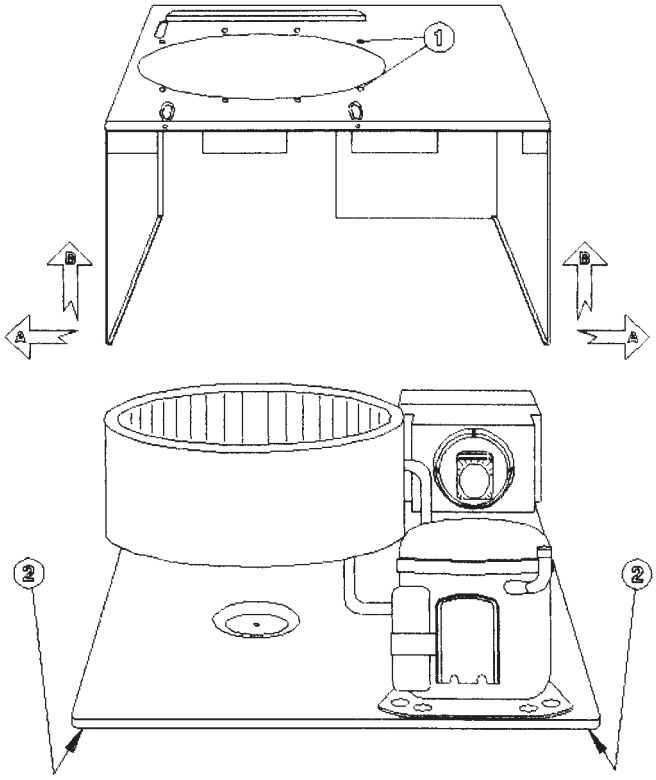
Dismounting

Refering to procedures already described and to the following figure :

- Disconnect every cable.
- Remove the lid.
- Remove the motor.
- Remove the front panel.
- Remove the suplly rack.
- Remove the Microprocessor + pcb.
- Insert a block between the body and the bowl to support the bowl.
- Unscrew the eight screws (1) which bind the bowl.
- On the body : unscrew the five screws of the left side (2) and the five screws of the right side (2).
- Now, the centrifuge walls are separated from the body. To extract them, bend the wall to the outside (A) and lift the body (B).
- The refrigeration group remains fixed only to the body.

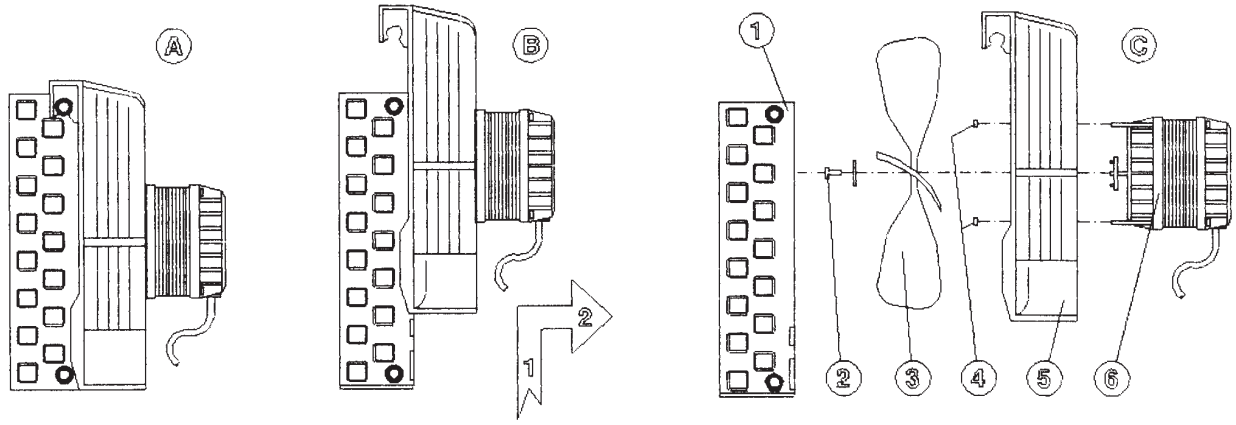
Refitting

- Carry out the above opeartions in the reverse order.



4.12.2. CONDENSER COMPONENTS REPLACEMENT

- Access the refrigeration group as escribed above.
- The condenser is in one block (A).
- Dismount it lifting and shifting the motor fan block (B).
- Separate the different parts (C).



4.13. MOTOR CHECKING

To check the motor electrical circuit integrity, continuity between phases has to be checked.

As there are three wires, such a measurement has to be carried out alternately, at the terminals of two of them, choosing the third one as common.

The two resistance values obtained referred to two successive phases (as the state circuit is star-configured). Check that :

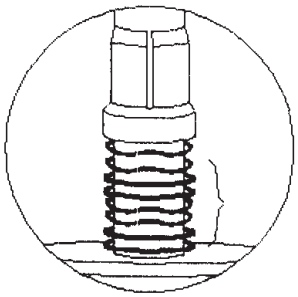
1. The two values are identical (allowable difference ± 0.2 Ω).
2. The two values are not lower than 7 Ω (± 0.2 Ω).
3. There is no discontinuity.

If there is no conformity to condition 1, the motor can run erratically.
If there is no conformity to condition 2, the motor can run irregularly with over heating.
If there is no conformity to condition 3, the motor cannot run.

4.14. CHECKING AND MAINTENANCE OF THE CENTERING GROUP

Referring to the following figure, it is very important to check :

- The numbers and the correct positionning of washers.
- The free movement along the centering core shaft.
- The correct greasing of washer (see spare parts).



5 CHECKS, ADJUSTMENTS, CALIBRATION

Replacement of spare parts and adjustment are done using standard tools of a maintenance engineer specialised in laboratory equipment.

As a guide, a list is given in the appendix. If, for a particular reason, any other tools are required, these are clearly specified in the relevant chapter.

5.1. IMBALANCE ADJUSTMENT

Adjustment procedure

When replacing the EPROM, all previously saved information is lost. In case of no calibration, to avoid unecessery repairs, the EPROM contains imbalance threshold default value 350.

> ⚠ WARNING : CALIBRATION MUST ALWAYS BE PERFORMED.

Thanks to a self learning of the vibration peak by the microprocessor, the calibration is no longer a manual procedure.

Carry out the following steps :

- Press simultaneously the ACCEL and BRAKING keys when the machine is switched on to access the configuration menu.
- The speed display will indicate TEST during three second, then the timer display will indicate T-1.
- Pressing START key will display IMBAL on the speed display and on the timer display :
  · If the EPROM has just been replaced the default value will be 350.
  · A value between 0 and 999 is possible if a calibration has already been done.
- Fit an S40 rotor.
- Simulate the maximum tolerable imbalance by placing an 8g weight in one of the inserts.

> ⚠ WARNING : THE ROTOR MUST BE PERFECTLY BALANCED BEFOREHAND.

- Close the lid and press PULSE key.
- Wait until the machine has completed the learning run. At the end of the run a value between 200 and 700 is displayed. If the result is different repeat the calibration. If you cannot succeed in having a good result, call the manufacturer's service department.
- Press STOP key to exit the configuration menu.

5.2. TEMPERATURE SENSOR CALIBRATION (CR3*i*)

Method of calibrating the temperature measurement system

Every time that the EPROM is replaced this operation must be carried out because of the loss of all previously saved information.

> ⚠ WARNING : NO TEMPERATURE SENSOR CALIBRATION WOULD RESULT IN BAD TEMPERATURE CONTROL

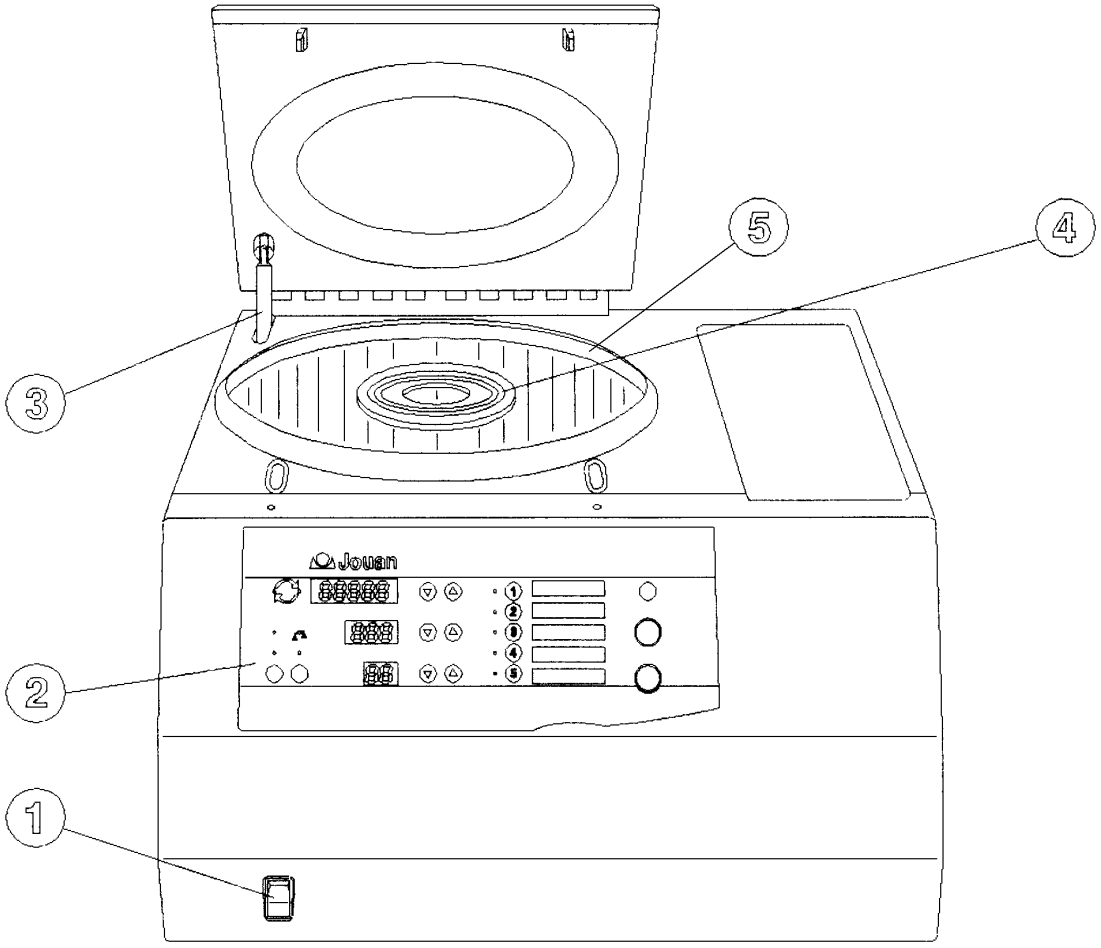
Thanks to a self learning of the chamber temperature, by the microprocessor, the calibration is not a manual procedure.

Carry out the following steps :

- Remove the front panel.
- Take of the J5 connector (of the temperature sensor), slot it in the next pin above.
- Press the ACCEL and BRAKING keys simultaneously when the machine is switched on to access the configuration menu.
- The speed display will indicate TEST during 3 seconds, then the timer display will indicate T-1.
- Press simultaneously the ▽ and △ temperature programming keys to run the learning cycle. Both speed and timer display will blink during 3 seconds (time of the learning phase). then the temperature display will indicate the value 37, meaning that the calibration coefficient has been calculated with regard to a reference voltage corresponding to 37°C.
- Press STOP key to exit from the configuration menu.
- Put the J5 connector back in its former position.
- Close the front panel.

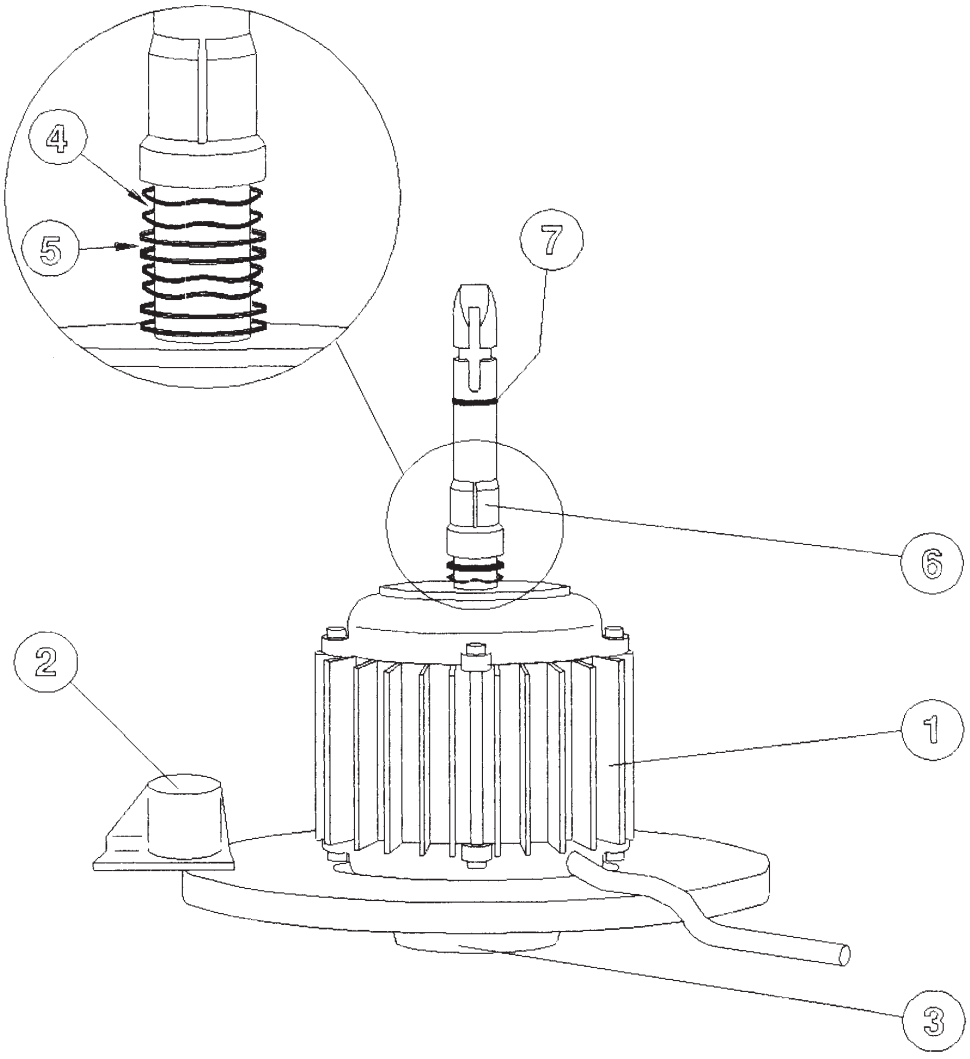
6 SPARE PARTS - DIAGRAMS

6.1. GENERAL



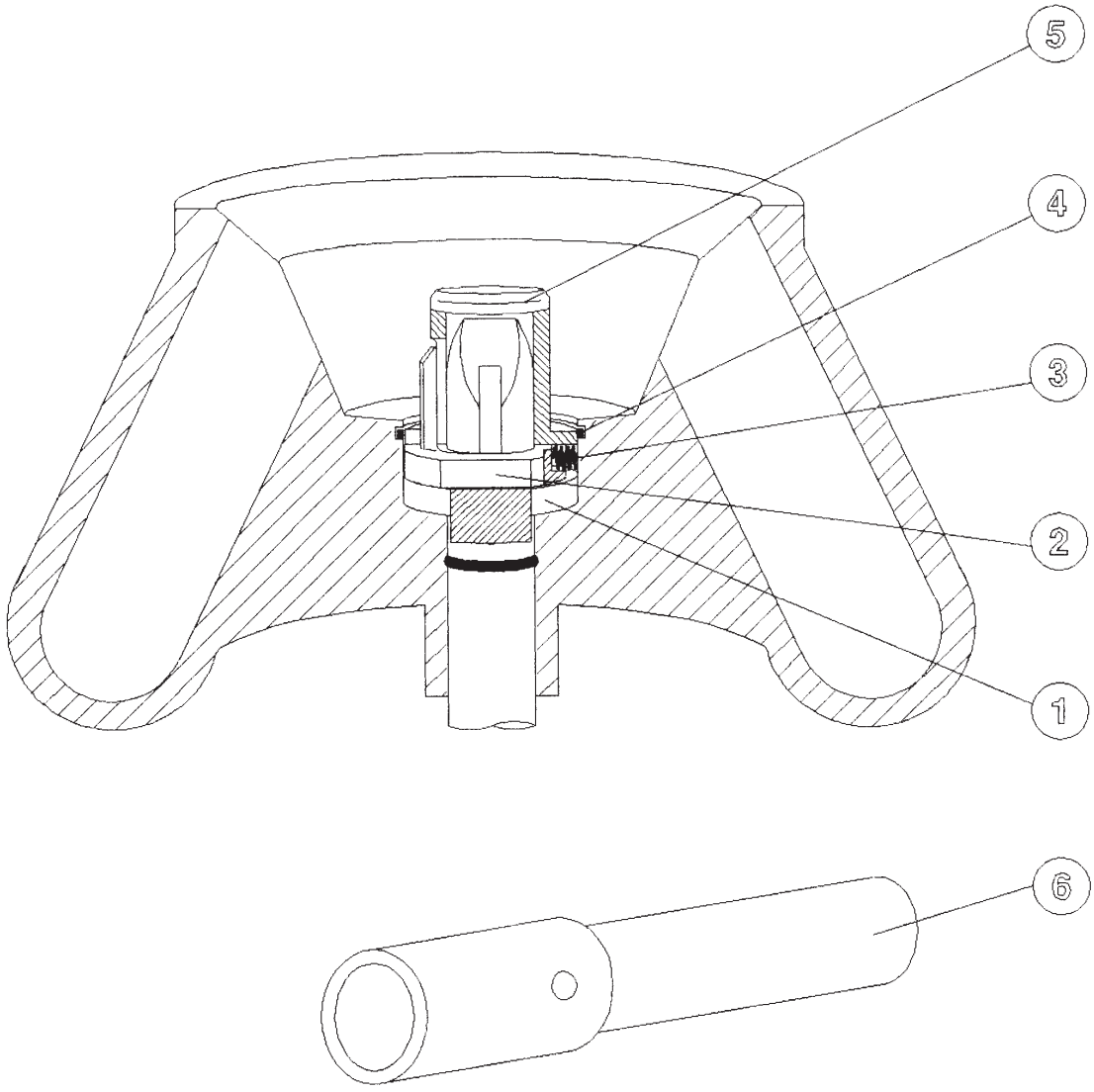
Item	C3*i* Cat. N°	CR3*i* Cat. N°	Description	Qty
1	89000838	86001434	Power switch	1
2	85220838	85220761	Keyboard	1
3	89000840	89000840	Gas spring	1
4	89000839	89000839	Motor chamber/bowl seal	1
5	89000841	89000943	Lid/bowl seal	1
-	85280460	85280460	Main p.c.b.	1
-	85280514	85280514	Display p.c.b.	1

6.2. MOTOR



Item	C3*i* Cat. N°	CR3*i* Cat. N°	Description	Qty
1	89000836	89000836	Motor	1
2	89000843	89000843	Load imbalance sensor	1
3	89000853	89000853	Elastic suspension	1
4	89000851	89000851	Spring washers	4
5	89000850	89000850	Washers	4
6	89000849	89000849	Motor shaft clamp	1
7	89000852	89000852	O-Ring	1
-	89000853	89000853	Tachometer sensor assy	1

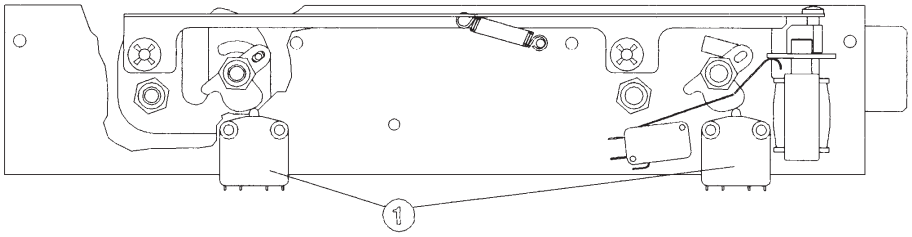
6.3. AUTO-LOCK SYSTEM



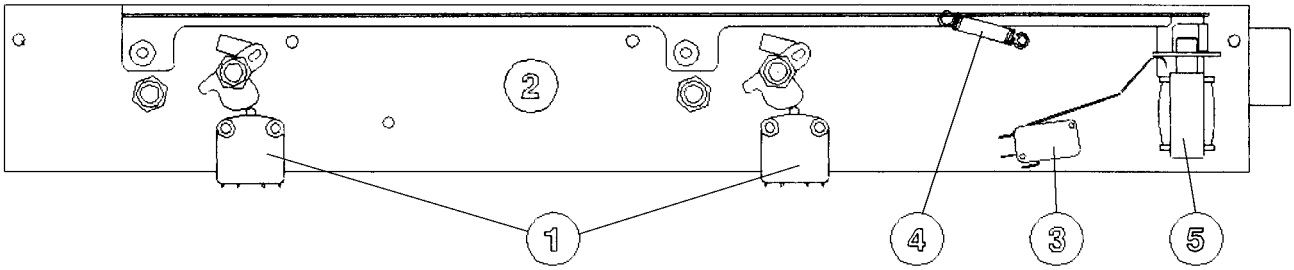
Item	C3*i* Cat. N°	CR3*i* Cat. N°	Description	Qty
1	89002451	89002451	Guide collar	1
2	85230757	85230757	Latch	1
3	86001482	86001482	Spring	1
4	86001600	86001600	Circlip	1
5	89000917	89000917	Latch guide	1
6	89002391	89002391	Rotating equipment unlocking device	1

6.4. LOCK

C3*i* lid lock



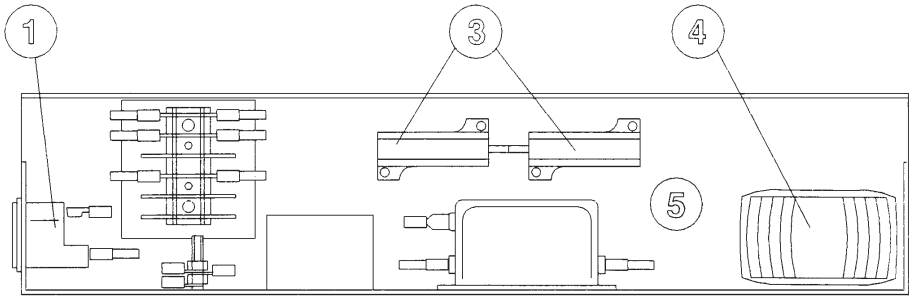
CR3*i* lid lock



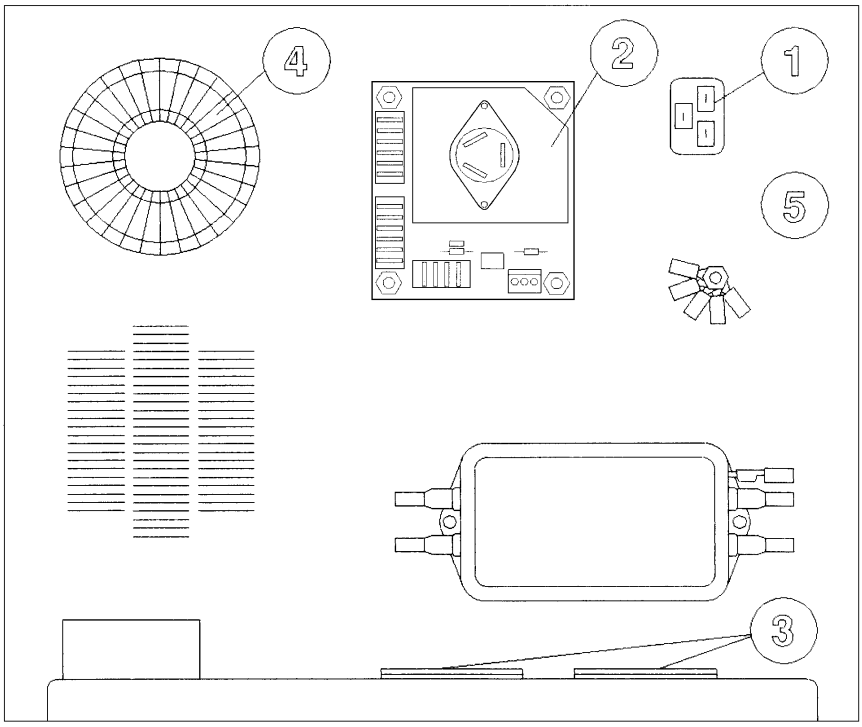
Item	C3*i* Cat. N°	CR3*i* Cat. N°	Description	Qty
1	89000842	89000842	Lid microswitch	2
2	89000844	89000844	Lock	1
3	89000845	89000845	Solenoid switch	1
4	89000846	89000846	Locking system spring	1
5	89000847	89000847	Lid solenoid	1
6	11202913	11202914	Locking system assembly	1

6.5. FEEDER GROUP

C3*i* feeder group

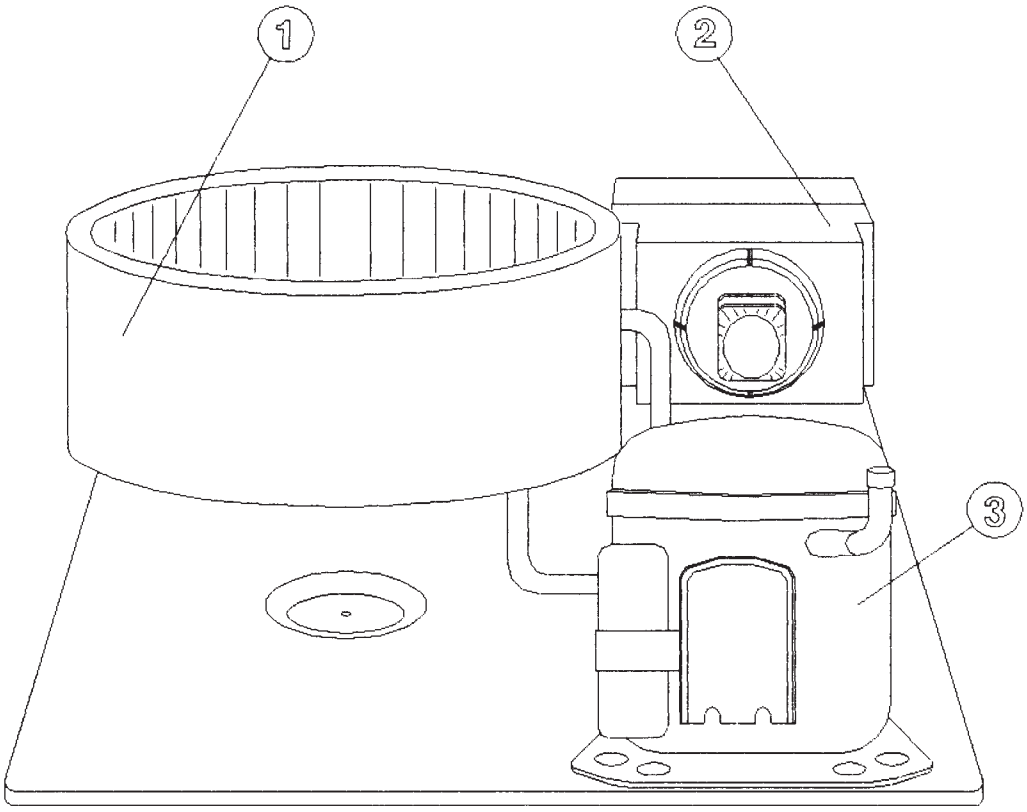


CR3*i* feeder group



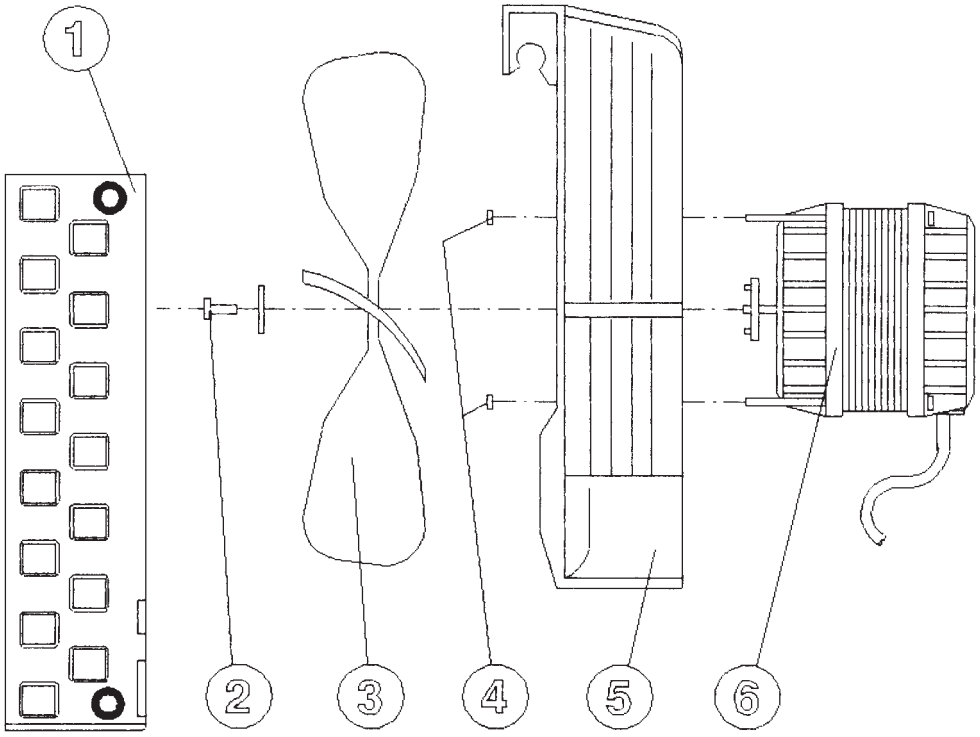
Item	C3*i* Cat. N°	CR3*i* Cat. N°	Description	Qty
1	89000900	89000900	Mains connector	1
2	-	85280383	Compressor p.c.b.	1
3	89000854	89000854	Braking resistor	2
4	89000837	89000837	Transformer	1
5	89000855	89000882	Feeder group	1

6.6. REFRIGERATION GROUP (CR3*i*)



Item	C3*i* Cat. N°	CR3*i* Cat. N°	Description	Qty
1	-	89000902	Bowl assembly	1
2	-	89000903	Condenser group assembly 230 V - 50 Hz	1
2	-	89000904	Condenser group assembly 120 V - 60 Hz	1
3	-	89000905	Compressor 230 V - 50 Hz	1
3	-	89000906	Compressor 120 V - 60 Hz	1

6.7. CONDENSER GROUP (CR3*i*)



Item	C3*i* Cat. N°	CR3*i* Cat. N°	Description	Qty
1	-	89000907	Condenser	1
2	-	89000908	Screw	1
3	-	89000909	Fan blades	1
4	-	89000910	Motor nuts	1
5	-	89000911	Carter fan blades and motor	1
6	-	89000912	Motor 230 V - 50 Hz	1
6	-	89000913	Motor 120 V - 60 Hz	1

A ANNEXE

LISTE DE L'OUTILLAGE D'INTERVENTION STANDARD

1 Valise outillage métrique (type maintenance)

1 Chalumeau pour brasure cuivre

1 Manifold LP (0-8 bars) HP (0-30 bars)

1 Ampèremètre efficace vrai (True RMS) 0 à 6 ampères et 0 à 20 ampères

1 Multimètre/fréquencemètre :

- voltmètre AC/DC 0 - 500 V
- ampèremètre 0 - 10 A
- ohmmètre 0 - 1 MΩ
- fréquencemètre 0 - 2 KHz

1 Thermomètre à thermo-couple ou équivalent avec une précision de ± 1°C dans la gamme 0 - 40°C

A APPENDIX

RECOMMENDED LIST OF TOOLS FOR STANDARD MAINTENANCE

1 Tool case (metric)

1 Welding station for copper brazing

1 Manifold LP (0-8 bars) HP (0-30 bars)

1 True RMS Ammeter 0 to 6 A and 0 to 20 A

1 Multimeter/frequency-meter :

- AC/DC voltmeter 0 - 500 V
- ampmeter 0 - 10 A
- ohmmeter 0 - 1 MΩ
- frequency-meter 0 - 2 KHz

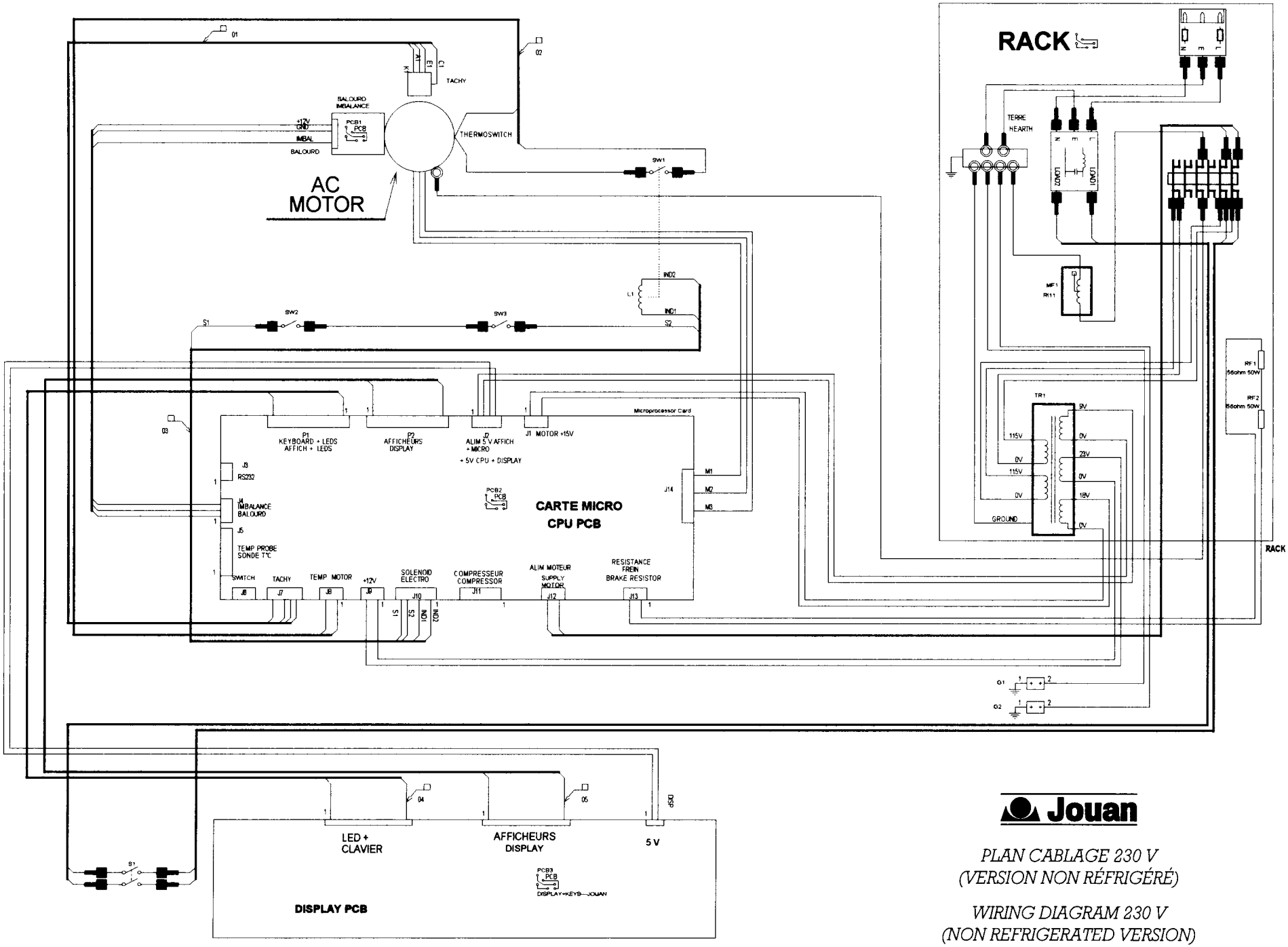
1 Thermo-electric couple thermometer or similar with an accuracy of ± 1°C in the range 0 - 40°C

B ANNEXE

SCHÉMAS ELECTRIQUES

B APPENDIX

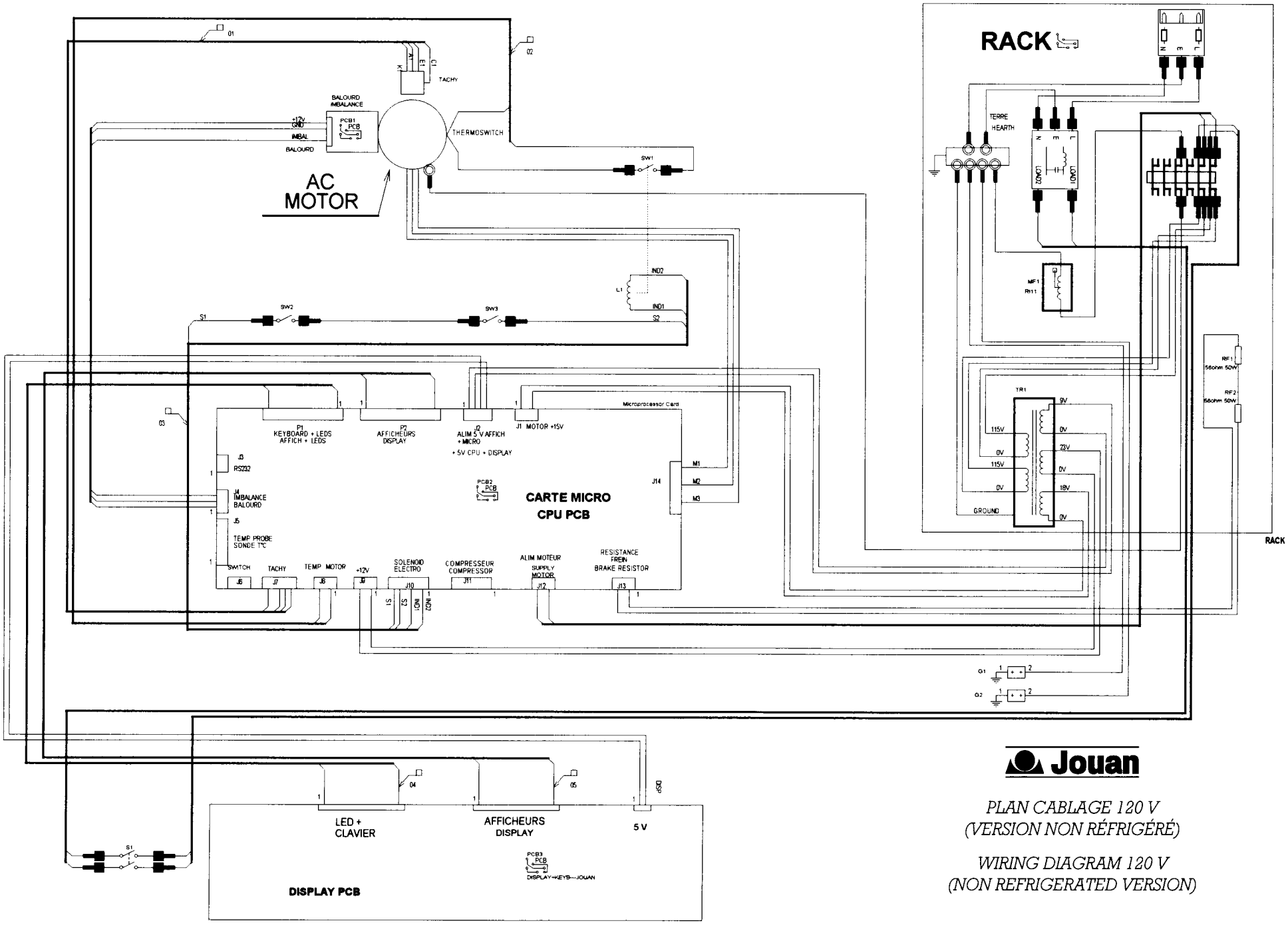
ELECTRICAL DIAGRAMS



Jouan

PLAN CABLAGE 230 V
(VERSION NON RÉFRIGÉRÉ)

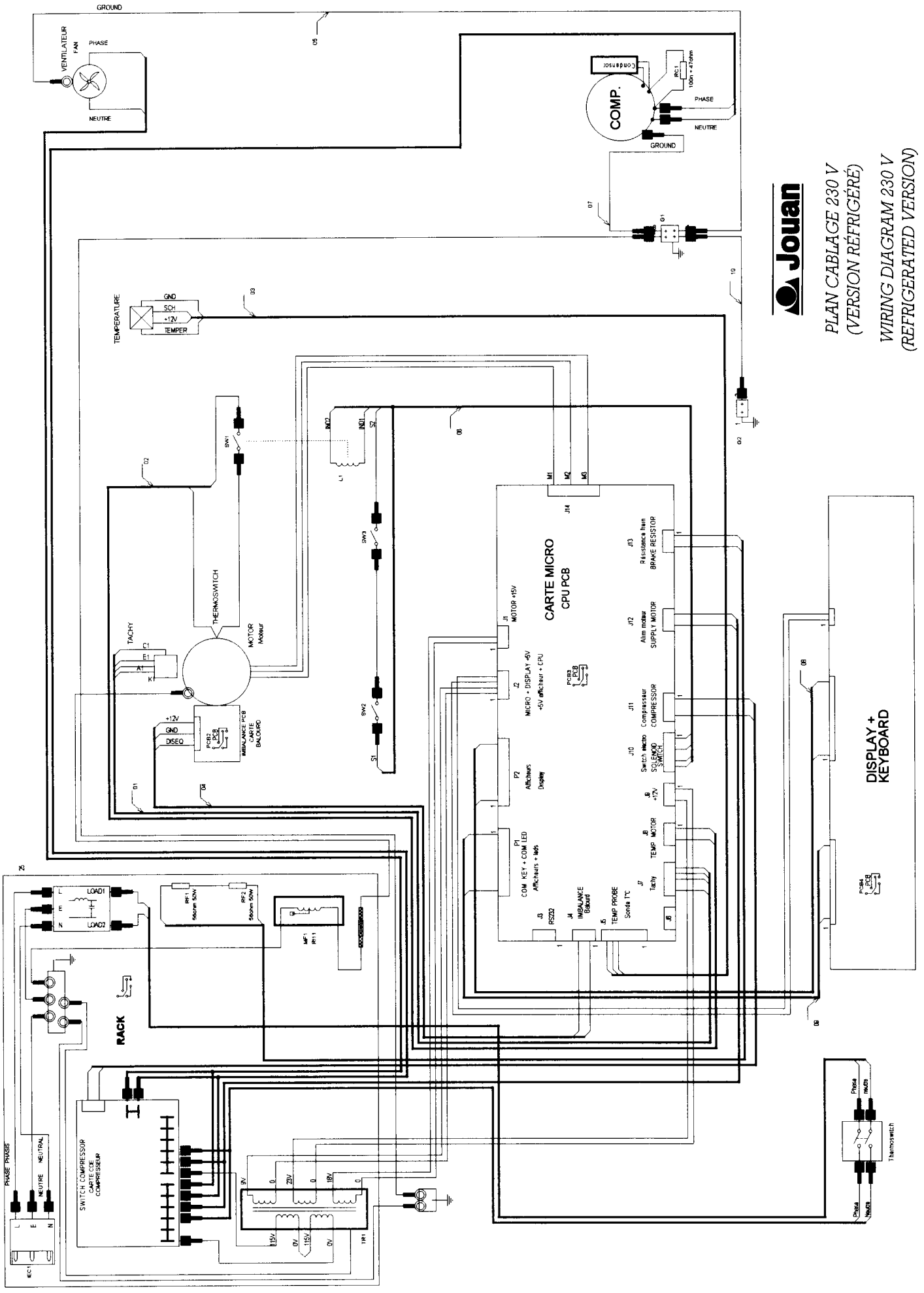
WIRING DIAGRAM 230 V
(NON REFRIGERATED VERSION)



Jouan

PLAN CABLAGE 120 V
(VERSION NON RÉFRIGÉRÉ)

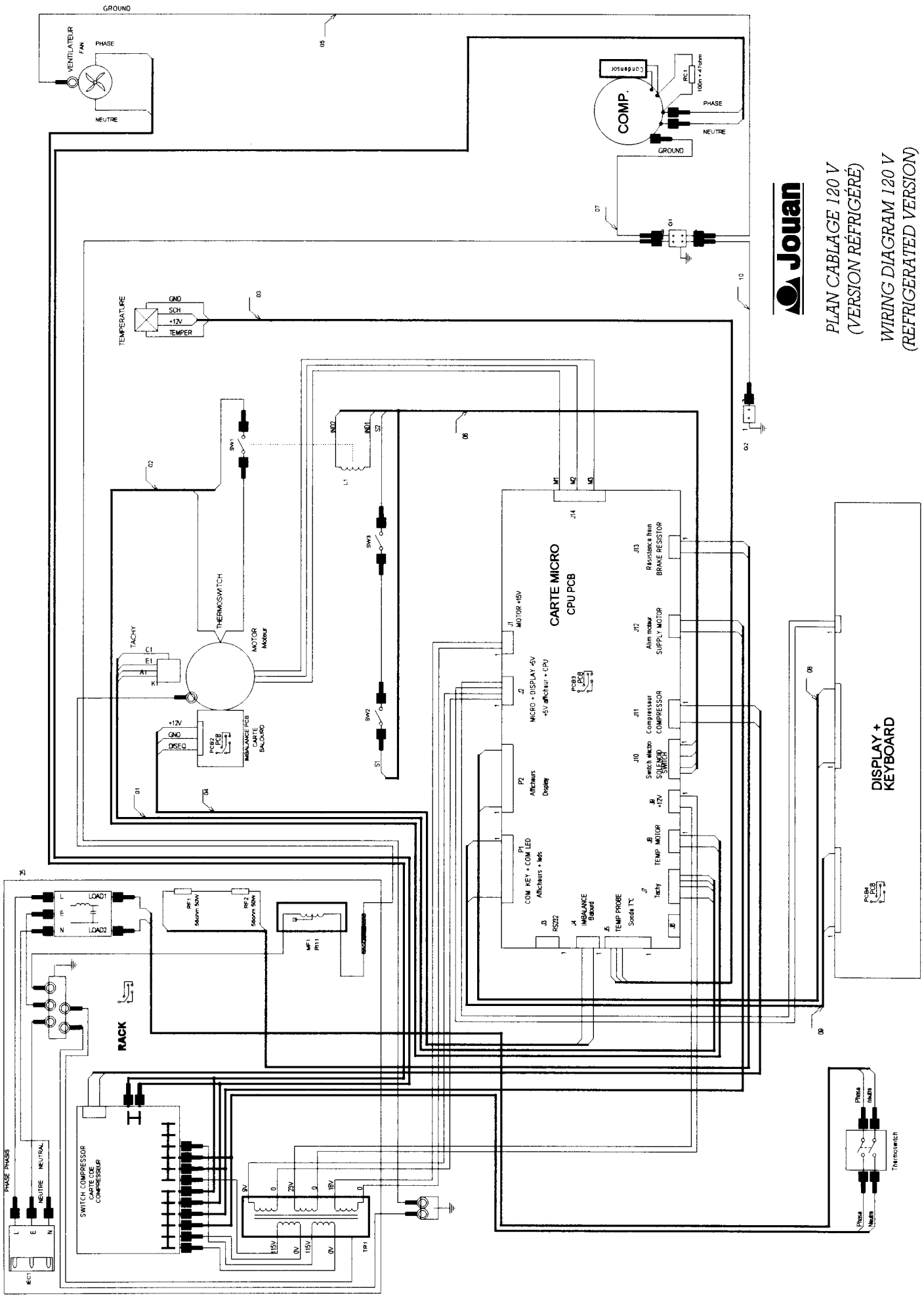
WIRING DIAGRAM 120 V
(NON REFRIGERATED VERSION)



Jouan

PLAN CABLAGE 230 V
(VERSION RÉFRIGÉRÉ)

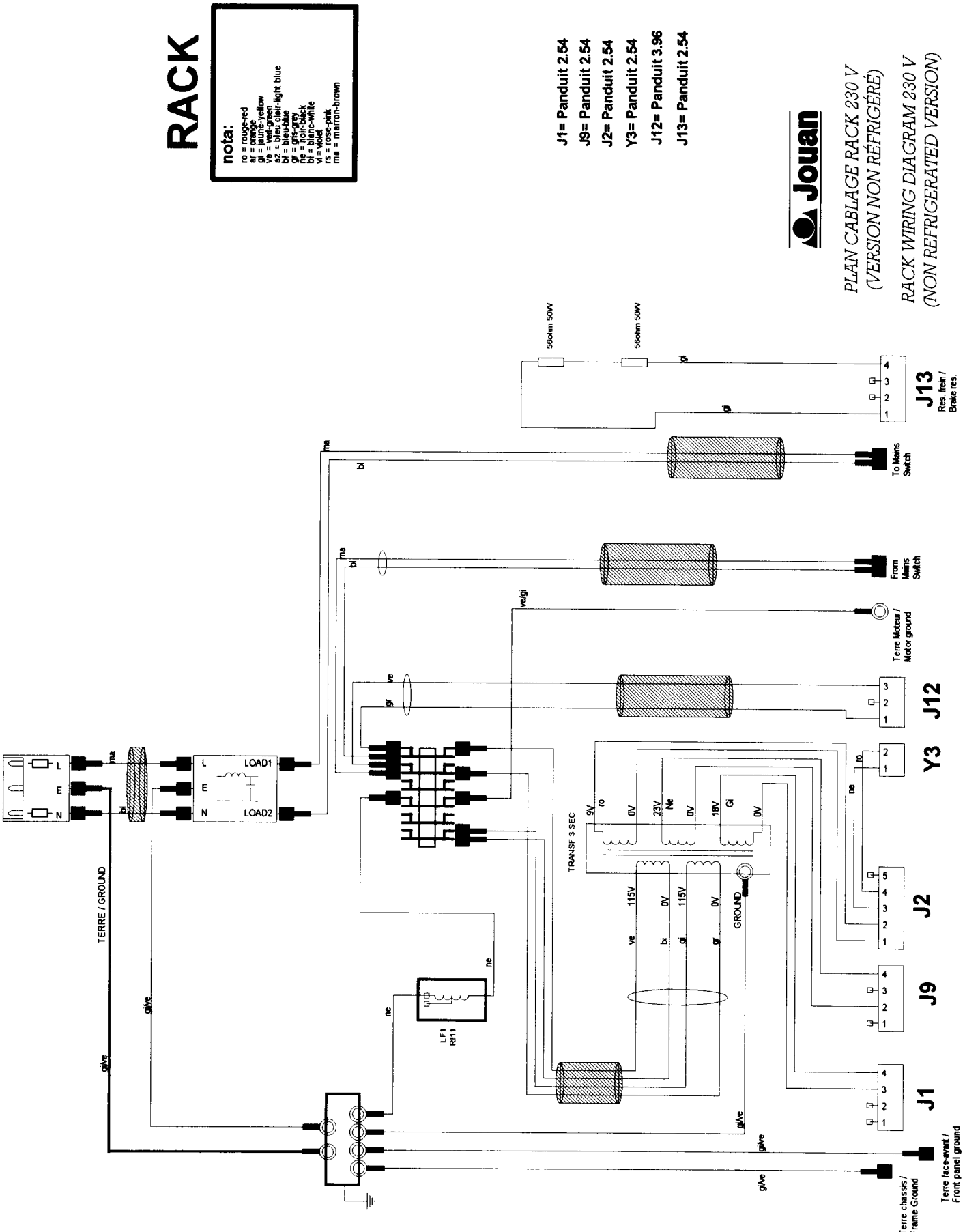
WIRING DIAGRAM 230 V
(REFRIGERATED VERSION)

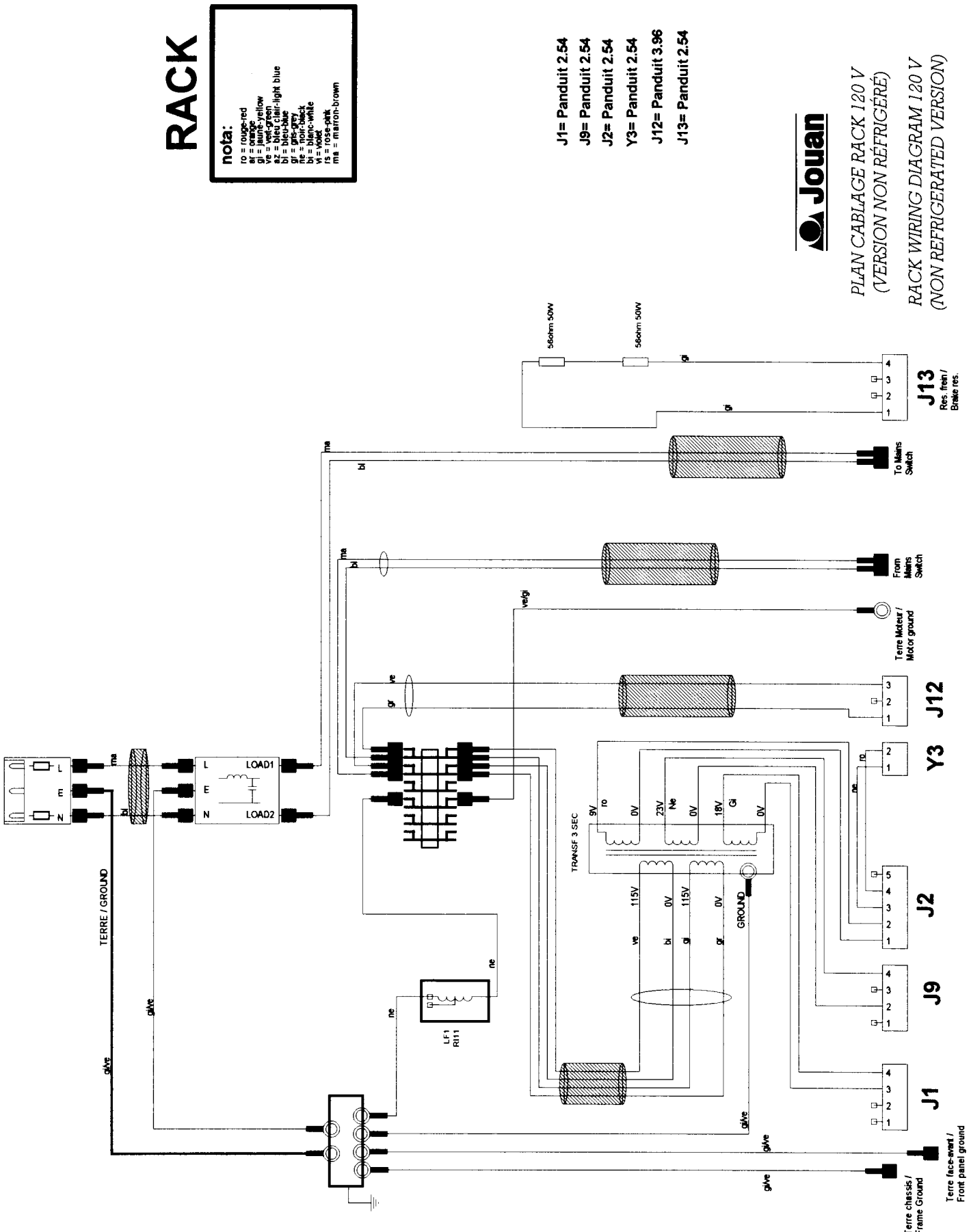


Jouan

PLAN CABLAGE 120 V
(VERSION RÉFRIGÉRÉ)

WIRING DIAGRAM 120 V
(REFRIGERATED VERSION)


RACK
nota:
ro = rouge-red
or = orange
gi = jaune-yellow
ve = vert-green
az = bleu ciel-light blue
bl = bleu-blue
gr = gris-grey
ne = noir-black
bi = blanc-white
vi = violet
rs = rose-pink
ma = marron-brown
J1= Panduit 2.54
J9= Panduit 2.54
J2= Panduit 2.54
Y3= Panduit 2.54
J12= Panduit 3.96
J13= Panduit 2.54
Jouan
PLAN CABLAGE RACK 230 V
(VERSION NON RÉFRIGÉRÉ)
RACK WIRING DIAGRAM 230 V
(NON REFRIGERATED VERSION)
56ohm 50W
56ohm 50W
J13
Res. frein / Brake res.
To Mains Switch
From Mains Switch
Terre Moteur / Motor ground
J12
Y3
J2
J9
J1
TRANSF 3 SEC
9V
0V
23V
0V
18V
0V
115V
115V
GROUND
LOAD1
LOAD2
TERRE / GROUND
LF1
RI11
Terre chassis / Frame Ground
Terre face-avant / Front panel ground


RACK
nota:
ro = rouge-red
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ve = vert-green
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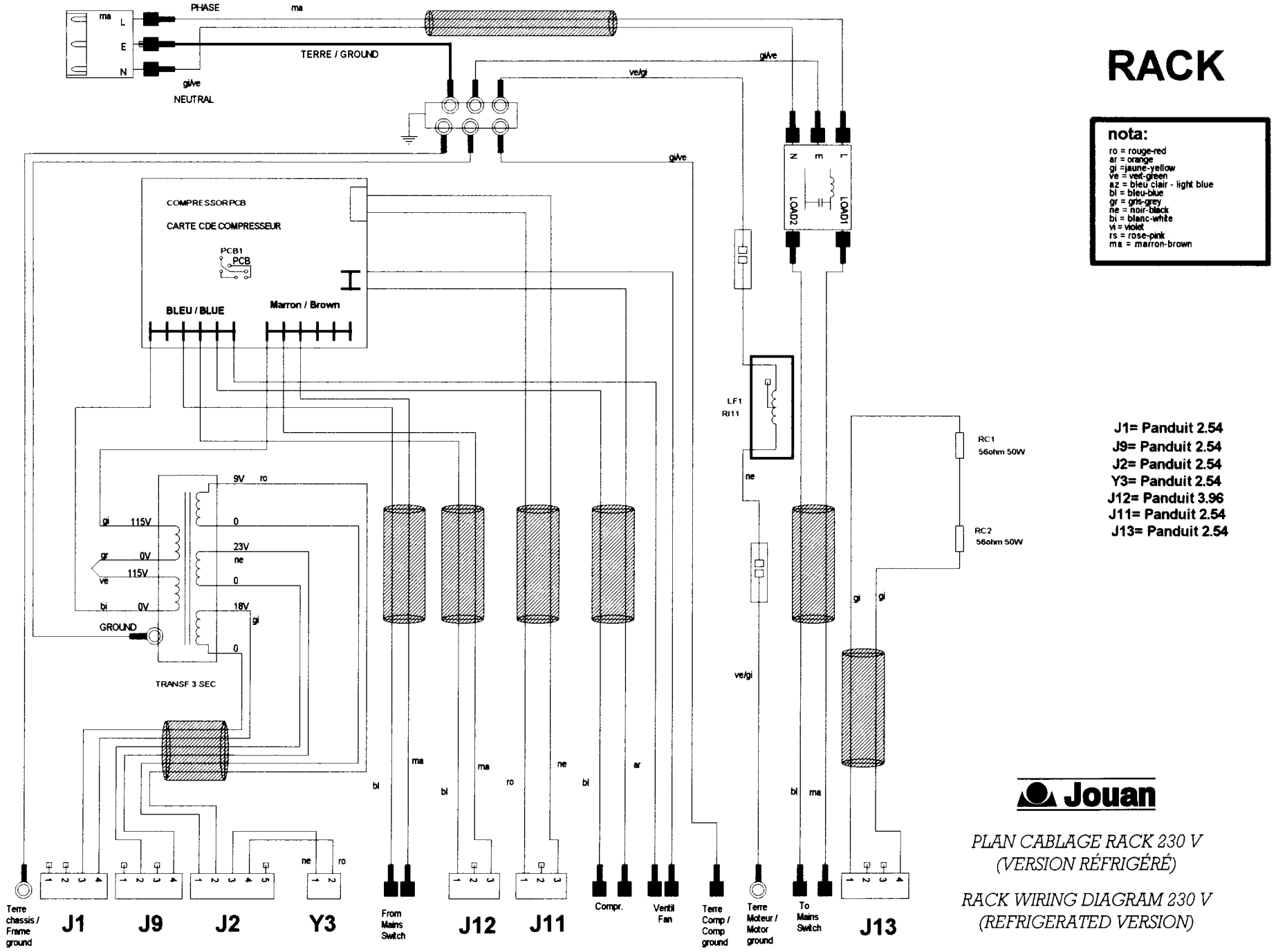
Y3= Panduit 2.54
J12= Panduit 3.96
J13= Panduit 2.54
Jouan
PLAN CABLAGE RACK 120 V
(VERSION NON RÉFRIGÉRÉ)
RACK WIRING DIAGRAM 120 V
(NON REFRIGERATED VERSION)
560ohm 50W
560ohm 50W
J13
Res. frein / Brake res.
To Mains Switch
From Mains Switch
Terre Moteur / Motor ground
J12
Y3
J2
J9
J1
LOAD1
LOAD2
TERRE / GROUND
TRANSF 3 SEC
9V
23V
18V
115V
115V
GROUND
LF1
R111
Terre chassis / Frame Ground
Terre face-avant / Front panel ground

RACK



nota:

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ar = orange
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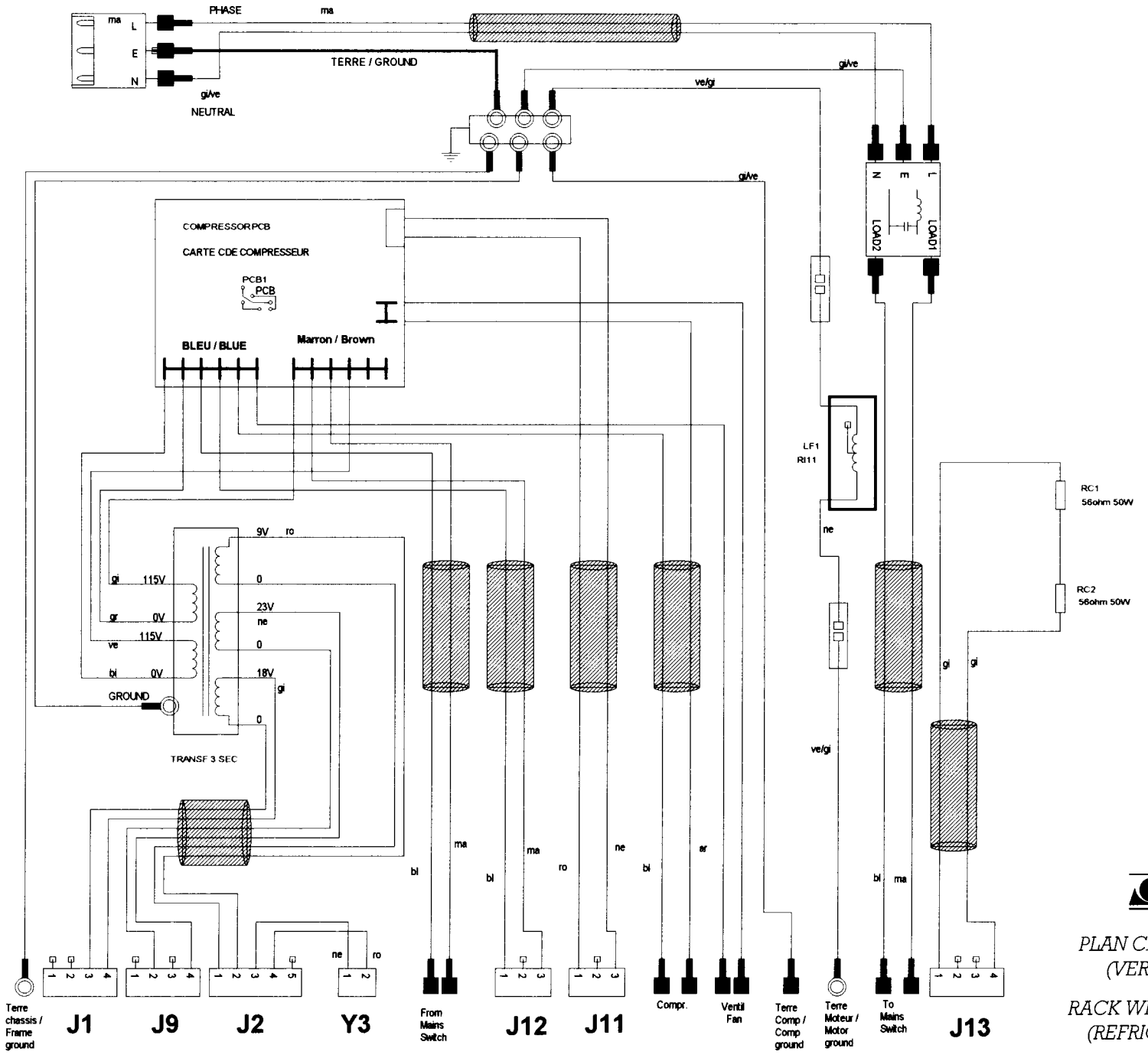
Y3= Panduit 2.54
J12= Panduit 3.96
J11= Panduit 2.54
J13= Panduit 2.54

Jouan

PLAN CABLAGE RACK 230 V
(VERSION RÉFRIGÉRÉ)

RACK WIRING DIAGRAM 230 V
(REFRIGERATED VERSION)

RACK



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Jouan

PLAN CABLAGE RACK 120 V (VERSION RÉFRIGÉRÉ)

RACK WIRING DIAGRAM 120 V (REFRIGERATED VERSION)